Implement This! Expanding Fiscal Federalism and Goal Congruence Theories to Single-Shot Games Utilizing a Bayesian Multivariate Frailty Model

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We advance and test a theory of goal congruence and compliance in single shot games building upon fiscal federalism and the study of grant management. We combine the insights from Pressman and Wildavsky's classic work with insights about goal congruence from principal agent theory. We examine how single shot grant games operate differently and thus require local government political institutions and administrative structures to foster credible commitments between federal and local authorities. The alignment of administrative institutions and goals is hypothesized to be an important condition for agent compliance with unwritten intentions.

Using administrative records from the U.S. Department of Energy and a national survey of local government recipients of DOE grants, we predict goal congruence and compliance. Since the goal of the federal government is to rapidly stimulate the economy and produce gains in energy efficiency, we investigate displacement as evidenced by delays in spending grant funds. Employing a Bayesian multivariate survival model, we estimate the time it takes from receipt of the stimulus grant until the funds are expended. An additive gamma frailty term is used to decompose city effects. We find compelling evidence that effective grant management is a significant factor in limiting delays.

When PA scholars reflect on Jeffery Pressman and Aaron Wildavsky's (1973) classic *Implementation*, often the first, and all too frequently the last, remembrance is that it is impossible to separate implementation from policy. This insight spurred research onto how the management of public programs impacts performance, but has also overshadowed some of the other contributions derived from their case study, such as program delay being a feature of policy failure, the role of grant management in producing successful policies, the role of organizational design in achieving desired policy outcomes, and the need for technically competent personnel to implement policy. However, one contribution that has not been appreciated is that this work provides the first and most detailed examination of single-shot grants.

Why invoke a 1973 text to study fiscal federalism forty years later? Because the Pressman and Wildavsky (P&W) investigation of the Economic Development Administration in the late 1960's has remarkable parallels to the implementation to grant programs of the American Recovery and Reinvestment Act of 2009 (ARRA). The Economic Development Administration was intended to stimulate employment and rejuvenate the stagnant economy of Oakland and other communities though a onetime federal investment in economic development infrastructure. The ARRA was also a federal one-shot investment to overcome a wide range of policy problems in a quick and dramatic manner. Like the earlier EDA program, it has been criticized as ineffective in part because of delays in spending funds. The recommendations that P&W derived from their analysis of implementation failures in the Oakland program provide an initial framework for developing a theory of single-shot grant games that delineates the distinct factors that influence outcomes in single shot versus

repeated play grant games. This paper expands and extends P&W's insights to produce a more general theory of compliance in single-shot grant situations.

Recent studies have continuously focused on fiscal outcomes, usually budgetary compliance, as the measure of successful policy implementation. We return to the salient issue of timeliness that P&W investigated in *Implementation*. P&W clearly demonstrated that one of the greatest failures of the Economic Development Administration was how deliberate and slow they were at executing the program's mandates. The torpid actions of the administrators doomed the program before any results could be evaluated. Single-shot grants such as the Economic Development Administration and the ARRA are intended to solve a specific problem in an immediate fashion, which is why expedience is an important program goal. Public perception is a key component in any performance evaluation of government programs, and if the implementation is sluggish then the public will likely assume that the program is ineffective even if results are realized further down the road.

We incorporate P&W's recommendations for effective grant implementation with fiscal federalism and principal agent theory to investigate local implementation of U.S. DOE Energy Efficiency and Conservation grant (EECBG) program under the ARRA. Previous research on fiscal federalism indicates that issues such as goal congruence and resource interdependency are motivating factors for achieving compliance in spending. However, these studies have been largely focused on reoccurring federal grants with repeated interactions around well developed policy arenas such as public safety and healthcare. Our study examines the case of a one-shot game in which no previous interaction between the granting authority and the recipient has taken place or is likely to occur in the future. Under this scenario, principle agent models would

predict that high levels of oversight are necessary. However, the EECBG program is largely reliant on transparency and reporting requirements which are relatively non-coercive mechanisms.

Why would local governments choose to follow federal archetypes given this game? We offer several answers to this question based off previous literature and our own research. First, previous fiscal federalism research argues that goal congruence is a major factor in achieving congruity and we offer an improved measure of the construct. However, we propose that goal congruence is not a sufficient condition for achieving compliance in single shot games and that additional factors must be present. Second, as P&W suggest, grant management with clear guidance from the principal is a key to achieving outcomes in single-shot games because of the inability to rectify mistakes through repeated interactions. We expect that cities involved in sustainable energy efforts prior to the stimulus funding will spend the funds energetically. Finally, the current literature on fiscal federalism is silent on the role of local political institutions in determining spending outcomes. We purpose that political institutions can play a moderating role in conforming spending priorities for situations without repeated interactions. In order to test these hypotheses, we use a national survey of energy grant recipients. The dependent variable is delayed spending with cities which have not yet outlaid funds being treated as censored observations. We employ a frailty survival model predicting the delay in spending after the grant approval process is completed. Frailty terms are included to adjust for multiple grants being given to the same city. The model is estimated using Bayesian techniques.

The paper proceeds as follows. In the next section we provide a brief background on the EECBG program. We then review the literatures on fiscal federalism and advance a theory of

grant compliance for single shot games. We describe the data and methods to empirically test the propositions derived from this theory. In the analysis section we investigate compliance based on duration of delays in expending EECBG funds with a Bayesian multivariate survival model. A gamma distributed frailty term is used to decompose city effects. In conclusion we discuss the implications of our findings for research and program design.

EECBG

The Energy Efficiency and Conservation Block Grant (EECBG) program to reform energy policy at the community level was an innovative milestone for the ARRA. The EECBG program was one of the first large-scale investments of federal funds into local governments since the Great Society. While the EECBG program has multiple components including funding to Indian tribes and some competitive funding, almost sixty percent of the funding went to block grants for large municipalities and that is the focus of this study.

The Department of Energy (DOE) administered the EECBG program. The DOE had almost no direct interaction with local governments prior to the EECBG as most of its funding passes through states. Even though the block grants were allocated by formula, local governments had to complete applications including detailed plans on how they would spend the funds towards energy conservation and sustainability. The submitted projects had to be approved by DOE as fitting into one of fourteen broad categories of spending that were permitted.

While the political debate continues on the impacts of the ARRA stimulus, the actual implementation of the programs such as EECBG have received little attention. The federal

government expected funds to be dispersed expeditiously in order to stimulate the economy and the clean energy sector. Despite federal expectations, some municipalities have torpidly dispensed funds indicating goal displacement and accountability problems. Therefore, the EECBG program provides a near optimal setting to test explanations for goal compliance in single shot grants.

Theoretical Framework

Our explanation of goal compliance in single-shot games integrates several streams of literature. We begin by reviewing salient issues in the fiscal federalism and principal agent literatures. We then proceed to identify the specific contributions of P&W and incorporate them into our framework.

Fiscal Federalism:

One of the classic rationales for employing grants is to overcome externalities and achieve Pareto optimal outcomes (Mueller 2003). Intergovernmental grants have traditionally been one of the chief policy tools used by the federal government to increase production of public goods at the local level, particularly when information asymmetries or other externalities prevent optimal levels of output. An early contribution in the study of fiscal federalism and grant effectiveness is Gramlich's (1977) typology of grants which predicts that grants that impose more restrictions on agents spending will be more effective at achieving their goals. Numerous studies conducted in the following decades produced only mixed support for this

prediction, until Chubb (1985) applied a principle agent framework to study the effectiveness of various forms of intergovernmental grants. Principle agent models allow for the inherent information asymmetries between the grantor and the recipient to be formally modeled and provide prescriptions to overcome moral hazard and conflicts of interest. Chubb assumed that recipient governments and the grantor agency disagreed over program goals, asymmetric information existed, and subordinates would shirk their responsibilities given the opportunity. Chubb demonstrated how monitoring and oversight influence grant effectiveness.

While principal agent theory (PAT) has become ubiquitous in the policy literature, the original PAT models applied to bureaucracy (Miller, 2005) and intergovernmental grants impose restrictive assumptions (Holmstrom, 1979; Shavell, 1979). Several scholars extended and adapted PAT to include multiple principals (Moe, 1984), procedural controls (McCubbins et al. 1987), irrational agents (Miller and Whitford 2002), and agents with varying levels of preference divergence from the principal (Nicholson-Crotty, 2004). One clear implication to be drawn from this literature is that political institutions matter. Yet, many studies of intergovernmental grants continue to neglect the role of political institutions, in particular at the local governmental level. We incorporate several measures of local political institutional configuration in our analysis.

Nicholson-Crotty (2004) finds that goal conflict is a major factor in the effectiveness of grants. Nicholson-Crotty uses political ideology to measure goal conflict in law enforcement and health care. We extend this line of research by employing a more direct measure of goal conflict. Nicholson-Crotty's measure is adequate for policies which have a clear ideological divide, but energy policy has advocates and detractors on both the left and the right.

Conservatives push for energy independence for national security issues, liberals often oppose certain sustainable energy sources such as nuclear power and biomass. We provide a more direct measure of goal agreement across multiple policy dimensions for policies where ideology is not a sufficent proxy. In addition to an improved measurement, we also expect the effect size of goal agreement to be larger for single-shot grants because, in absence of repetition, alternative methods of developing trust must emerge to achieve compliance.

Pressman and Wildavsky:

P&W offered a groundbreaking case study of implementation, yet it is difficult to characterize their recommendations as a theory of implementation or grant management. Instead, it provides a detailed case study and a list of prescriptions for future practitioners. They propose reducing the number of decision nodes in the system by creating simple approval processes, creating an organizational machinery for the execution policies, maintaining flexibility as program goals evolve, incorporating policy learning, and the importance of employing staff that can make systems work as opposed to simply having specific knowledge in a policy area. P&W rebuffed the theories that an organization external to the bureaucracy or coordination activities could overcome implementation delays. We employ fiscal federalism and principal agent theory to both encapsulate and expand the P&W recommendations into a more generalizable theory of implementation for single shot grants.

A frequently overlooked aspect of P&W's work is the focus on how delay contributes to program failure. Studies of grant effectiveness largely focus on funding levels (Bailey & Connolly, 1998; Becker, 1996; Gramlich 1977; Hines & Thaler, 1995) and compliance with

procurement. However, single-shot grants are more likely to be stimulative in nature or employed to address a serious yet temporary public problem. The EECBG grant program has multiple goals for economic stimulation, and the promotion of sustainable energy under a short time constraint. P&W demonstrate that spending delays can hinder performance and accentuate the perception of failure. This is analogous to delays in the ARRA's "shovel ready" projects. Even though projects may produce desired benefits over a longer time frame, P&W found that those programs were deemed failures based on expenditure data because the program was designed to produce rapid economic stimulation. Thus, P&W provide a basis for applying implemntation delay as a viable measure of grant effectiveness.

In addition to the focus on timeliness of spending, they focused on a second issue neglected in the current literature - the impact of management. The public management literature has produced numerous volumes on procurement and proper management of grants from accountability and fiduciary perspectives, but relatively few studies that indicate how quality grant management and administration can impact performance. Several studies include monitoring and oversight, but only as a small part of the grant management process. Providing assistance and guidance during the application phase, having a transparent approval process, and an orderly fund disbursement policy are all important elements of grant management that must occur before monitoring can take place. While grant management undoubtedly impacts both single and multiple period grants, we expect single-shot grants to be more heavily impacted by management because the lack of repeated interactions is not present to align goals. We include several measures of grant management quality in our analysis to account for these issues.

Implementation makes the point that simple knowledge of the policy area is not sufficient and that experienced personnel who can get the job accomplished are required. This relates to a key issue for single-shot grants, mainly the resources and capabilities of the agent. For repeated, multiyear grants local governments will hire or contract with full time personnel and will retain a core competency. Local governments are less likely to hire a full time staff member to deal with a short term grant and therefore are going to rely more on the resources currently at their disposal. P&W focused only on one of the resource limitations facing agents when dealing with single-shot grants, and we expand the scope to cover human, fiscal, and relational restraints which do not restrict games with repeated interactions.

One of the more interesting conclusions of P&W is that coordination is not a plausible solution for overcoming barriers to implementation. The authors contend that coordination is only possible when goal agreement is already present. In the absence of goal agreement, coordination reverts into negotiating compromises and adds additional decision points, thus delaying the process further. P&W view the bureaucracy of grants as an accountability system, which is why we focus on the improvement of the grant process and not on alternative policy tools for accomplishing ARRA goals.

In summary, several noticeable lacunas exist in the fiscal federalism literature. Previous studies have focused on states, thereby neglecting local political institutions. The literature employs measures of goal conflict that limit generalization to multiple policy areas. The impact of grant management on outcomes is almost entirely neglected. The nature of single-shot grants dependence on already accessible resources is not addressed in the literature and few

studies empirically investigate delay as a form of program failure. This research begins to fill these voids through analysis of local implementation of the EECBG program.

A Theory of Goal Compliance in Single-Shot Games

The literature review reports that empirical research done on grant compliance has mostly focused on repeated play games. Single-shot games have a different dynamic because players can't punish unwelcomed behavior in future periods and therefore face higher risks of defection. Therefore, principals may need to focus on institutional arrangements that go beyond the carrot and stick approaches of the classical principal agent model.

Intergovernmental grants are contractual relationships. Therefore increased monitoring is the conventional solution for deterring defection. However, monitoring is expensive and is complicated when agents are contracting out work with grant funds to sub-contractors. Thus, lines of accountability become blurred. It is not difficult to imagine a situation where the monitoring costs would become prohibitive so as to exceed the amount of grant funds. Moreover, monitoring is almost always hindsight. Single-shot grants only give the agent one chance to achieve the principal's goals, and if the funds are misallocated then project failure is eminent. Single shot games therefore require a forward looking mechanism to achieve compliance.

The need to monitor can be overcome by decreasing transaction costs through increased trust. Goal agreement is one of the most dominant factors in grant effectiveness regardless of the how many time periods the game lasts (Nicholson-Crotty 2004) for the simple reason that it enhances trust among participants. Goal agreement acts as a proxy for common

knowledge and allows the principal and the agent to more accurately predict eachothers' moves. Goal agreement takes on additional weight when two parties have not interacted before, as is the case with EECBG grants, because they have no prior beliefs to base their expectations on. Additionally, lack of previous interaction increases information costs because of the need to open new lines of communication. Research has shown that when goal agreement is present among groups in a network, they are more likely to share information and work together (Lubell 2007). Goal agreement therefore serves a greater role in single shot games.

Trust in single policy interactions might also be produced by observation or knowledge of past behavior. Cities which have previously enacted similar or corresponding green policies may be presumed by the grantor agency as more likely to implement policies consistent with the principal's energy efficiency and conservation goals. The observation of previously related behaviors is based on the idea of path dependency (Arthur, 1990) and that the best indication of future behavior is the behavior during the previous period.

P&W argue that reducing the number of decision nodes can reduce delays in implementation and view collaborative efforts as a possible hindrance that increases decision making costs. However, collaboration among agents and other actors could also be seen as a method for decreasing both administrative and information costs through the elimination of redundant positions and the sharing of best practices. Additionally, if the public and outside groups are permitted to participate in the grant proposal process, then the collaborative efforts are initiated with a clear understanding and commonly accepted expectations for the program. In these cases, we would expect collaboration to have a net positive effect.

Collaboration frequently reaches beyond community interests and surrounding communities in order to seek out knowledge and abilities which are unavailable locally. While single-shot grants can be given for any type of public problem, they are usually assigned to issues which are caused by unique events and therefore may require a specific or rare expertise. In these situations, turning to research universities, state agencies, or federal departments with skills absent from the local community may be necessary. These collaborative relationships are not regulatory, they are for advisory information and therefore should help increase the ability of the local government to achieve goal compliance.

Compliance in single-shot games may be closely related to how well the grant is administered. P&W suggest making the decision-making/grant process as simple as possible in order to streamline the administration. From a transaction cost perspective, simple grant processes reduce ambiguity for both parties and lower administrative costs. Simple processes are easier to implement for straightforward problems, but single shot grants are most likely to be employed in situations where a complex, temporary problem has arisen. Grants are often conceptualized merely as a transfer of resources, but grants serve as a method for transmitting knowledge as well. Requests for grant funds almost always require a plan for fixing a policy problem which is reviewed by experts in the subject matter. The grant approval process therefore serves as a quasi-peer review for practitioners and allows their plans to be evaluated. Principals can use this process not only to command compliance, but also to share best practices and knowledge. The EECBG program is an acute example of this phenomenon. Most local governments were not technically savvy in regards to energy policy and therefore need direction from the DOE on how to properly apply and spend funds for sustainability. Principals

who provide clear guidelines and assistance throughout the entire processes are more likely to realize compliance and improved performance as a result of clear expectations and reduce the likelihood of errors in applications.

One key point related to grants management is that monitoring and reporting is only one part of the process, even though it has achieved the most attention from PA scholars. Developing simple application processes, providing assistance and feedback to agents, timely dispersal of resources, and many other factors which impact performance occur before monitoring can take place. Errors by the principal in managing any portion of the grant administration can negatively impact the agent's results, even though the causes were out of the agent's control. Agencies can focus on monitoring for repeated games because there is always the option to correct any mistakes in the next round, however in single shot games monitoring is too little too late and more resources must be focused on the front end of the process.

A final issue which impacts single-shot grant compliance is political institutions. Governments designed to look out for long term interests are more likely to comply with grant requirements to avoid any negative stigma on their reputation. Political institutions with short term horizons or those which represent narrow constituencies are more likely to default and take any short term gains from noncompliance.

Hypotheses

Federal principals face an array of agent types because local political institutions are more diverse than state and federal authorities and these institutions shape the incentives and

motivations of local actors (Clingermayer and Feiock 2001). Cities managed by a professional administrator are expected to have a long-term horizon as opposed to mayoral cities where short –term political considerations are expected to carry more weight. The trade-off between long-term and short-term benefits is extremely salient in energy policy where quick and painless gains can be made by switching light bulbs or risky investments in sustainable energy can take years to produce financial gains. These trade-offs are not always so drastic. In the case of switching to energy efficient light bulbs, there is still an upfront cost which is recouped with energy savings. Professional managers are expected to be more willing to make the investment in cost saving technologies more expeditiously than mayors who may feel that gaining interest off the public coffers better suits their political goals.

H1: Council-manager government cities are expected to initiate implementation of EECBG projects more quickly than mayor-council cities.

City and county councils are elected either at-large by the entire geographic area or by districts where the electorate is more localized. District representation is associated with constituency politics and is usually seen as less willing to engage in collective action problems or to support policies which may impose costs to their constituents. While infrastructural energy projects such as new power plants can be placed in specific areas and therefore have geographically centered benefits, energy policy generally has distributed benefits such as lower utility bills which benefit the entire population uniformly. Since district representation is generally less supportive of collective policies, we expect them to be on average against to energy policy initiatives.

H2: Higher percentages of district representation are expected to initiate implementation of EECBG projects less quickly.

Previous studies have found goal agreement to be positively associated with spending compliance, but have not addressed how it would impact timeliness. Previous studies have also focused on programs with unitary goals, such as crime reduction, and not multiple expectations. The enabling legislation states four goals for EECBG programs: 1) reduce fossil fuel emissions; 2) reduce the total energy use of the eligible entities; 3) improve energy efficiency in the transportation, building, and other appropriate sectors; and 4) create and retain jobs. For each of these issues, we measure the level of agreement with the local community's energy policy goals and we combine them using a factor score to produce a measure of common goal agreement. We expect communities with higher levels of common goal agreement to begin projects in a more timely fashion.

H3: Cities with lower levels of goal agreement are expected to initiate implementation of EECBG projects less quickly.

Comprehensively measuring management quality is a daunting task, but at least one component of quality is customer satisfaction. Poor administration can lead to higher transaction costs and restrain local implementation efforts as P&W reported in their classic work on the Economic Development Administration. We include several measures of grant recipient satisfaction for several stages of the application process. As P&W point out, there are numerous decision nodes from which implementation can be hindered and we believe it is important to measure quality at each stage in the process. We include measures for the application, technical assistance, dispersal of funds, and a general overall satisfaction measure.

The expectation is that recipients who received high quality service from the Department of Energy's administration at each point in the grant process will be more likely and able to start their projects on time.

H4: Municipalities with higher perceptions of DOE grant administration are expected to initiate implementation of EECBG projects more quickly.

In the absence of repeated interactions, one of the best gauges of future behavior is to examine previously adopted policies of the agent. We divide these up in to two groups with the first being a previous policy identical to the grant funding request. Cities who were already sponsoring sustainable energy programs had the option of continuing or expanding their efforts through EECBG funds. Many cities lacked the resources to implement large scale projects such as the EECBG program provided, but they still had numerous sustainability efforts in place prior to the grants being awarded. Many communities had adopted green practices, conservation efforts, or green planning initiatives. Whether the policy is a continuation of current practices or if the city has a history of green initiatives, we expect cities which have previously adopted green policies will be more likely to comply with EECBG goals and quickly spend their grant funds.

H5: Cities which have previously adopted green policies are expected to initiate implementation of EECBG projects more quickly.

P&W make the case for needing personnel skilled not just in technical knowledge of the issue, but with the capacity to implement programs effectively. We generalize this prescription to the resource dependent nature of grants. Grants by definition provide an influx of cash, but without the administrative capacity, technical knowledge, and political support necessary the

funds can only have a limited impact. We include measures of administrative capacity and collaborative efforts to gain information. We divide collaborative efforts into cooperation with other cities and regional entities and coordination with universities, state agencies, and federal departments other than DOE. Local governments who collaborate with partners in their community and at the higher levels of government are expected to spend funds more quickly than those who attempt to act independently.

H6: Cities with higher administrative capacities are expected to spend grant funds expeditiously.

H7: Cities which collaborate more with other governmental entities are expected to distribute funds more quickly.

Collaboration is helpful when it is a voluntary transaction of information, but as P&W suggest collaboration is a hindrance when it increases the decision-making costs. We therefore separate collaboration from interference and include several measures of obstruction to implementation. The first is a measure of DOE impediments concerning the grant process. Second, we include a measure of interference from other federal agencies, particularly the EPA and Department of Interior since they play are large regulatory role in energy policy. Third, we include a measure of support from local interest groups who might try to influence energy policy.

H8: Interference from DOE, other federal agencies, and local interests groups will all slow down the implementation of EECBG programs.

In addition to the variables above, we include a range of controls. EECBG grants were given in 14 different categories, and we include a set of dummies to account for any structural

differences among them. The value of the grant per capita is included to account for any scaling effects. Political ideology of the city council is included to account for any partisan effects. An indicator measuring if the community copied the legislation from another governmental entity is included to measure any isomorphic impact. Local political dynamics are covered by including the level of citizen support for green energy policies along with the amount of civic participation in the application process and media reporting. Demographics for city size, unemployment, education, and population density are all included but are currently measured at the county level. Finally, the localities are clustered by municipality since one city can have multiple grants.

Data

The data for this project were collected from a number of sources. The two main sources were Department of Energy administrative records which gave us the disbursement patterns for each grant and a national survey which we administered to all EECBG recipients. Our unit of analysis is the EECBG program for each grant. We focus solely on cities for this analysis and while each city only has a single grant, they may fund several projects out of that pool of money. Therefore, our grant data are clustered in cities.

The national survey went to all grantees and has thus far yielded over a 50% response rate. The survey was sent to the DOE contact for each city and they are expected to be knowledgeable of grant activities. However, data entry is still being done so only a subset of 2026 observations on 537 cities are used for this paper. Missing data were found on 443 observations and MCMC based multiple imputation was used to correct for this missing

information. All additional demographic data was taken from the U.S. Census Bureau online factfinder. Table 2 at the end of this section provides the summary statistics for all variables included in the analysis.

The dependent variable is the delay between the proposed EECBG project start time and the actual time funds were dispersed measured in days. This is taken directly from DOE administrative records. While many cities delayed EECBG projects, others actually started before their approval dates and refunded their public coffers once the money was dispersed. These cities therefore had a negative delay value. Since the statistical software will not consider negative times, a constant of 500 days was added to all delays. The addition of a constant does not change the analysis in any way other than a need to adjust any estimates. (In fact, since time is treated semi-parametrically only the ranks matter and not the actual distance between time points.)

The amount of the grant award and the type of project were also taken directly from DOE data. The grant amount was divided by the 2009 census population estimate to provide a per capita estimate for each individual project. The frequency of grant types is presented in Table 1. We collapse the categories of grants with under thirty observations into the "Other" category in the analysis for statistical reasons related to convergence.

Table 1: Frequency of Grant Type

Grant Type	Frequency
Building Codes and Standards	24
Building Energy Audits	115
Building Retrofits	675
Clean Energy Policy	166
Energy Efficiency Rating and Labeling	17
Financial Incentives for Energy Efficiency and Other Covered Investments	61
Government, School, Institutional Procurement	157
Industrial Process Efficiency	18
Loans and Grants	83
Other	97
Renewable Energy Capacity and Generation	3
Renewable Energy Market Development	122
Technical Assistance	151
Transportation	254
Workshops, Training, and Education	86

The majority of independent variables are taken from the survey instrument. Citizen advocacy is measured using a 4 point scale of "Not Important" to "Very important". The previous sustainability energy policy variable is a count of up to 7 programs that cities had implemented before grant funding was available. A binary variable representing if the city copied the policy from another government is included. All three satisfaction measures are measured on a 10 point scale with higher values indicating higher satisfaction with grant management by DOE.

The percentage at-large representation was calculated from the survey which asked for both council size and the division of seats by election type. City manager form of government is a dummy variable and is compared to all other forms of government, which is almost

completely mayoral. The city council ideology was measured on an 11 point scale ranging from "Very Conservative" to Very Liberal".

Factor analysis was conducted on several variables for data reduction purposes and the factor scores were included in the actual analysis. Appendix A has a complete list of the items included in each factor along with each item's factor pattern. Both scree plots and eigenvalues were used to determine the appropriateness of each factor, but only the eigenvalues are reported here in parentheses by the name of each scale. The eigenvalues can be roughly interpreted as the amount of shared variance explained by the factor. Goal agreement (.69) was measured as a factor with questions related to the four EECBG goals. The role of sustainability in economic development (.60) and planning (.75) are both factors produced using three questions with five point scales. Obstacles from the DOE (.62), from other federal agencies (.72), from local organizations (.74), and from lacking administrative capacity (.62) are all based on 5 point scales ranging from no obstacle to substantial obstacle. It should be noted that these variables are "reverse coded," meaning that higher values indicate a greater expected delay. Collaboration with surrounding entities (.78), collaboration with state and federal agencies other than DOE (.66), support from local interest groups (.64), and support from governmental agencies (.62) are also included.

Examining the eigenvalues for these factors shows that many do not reach the common psychometric threshold of 70%. Additionally, the questions were measured on a five point scale which means ordinality might be a concern. However, the distribution of the scores for the variables was quasi-normal and the residual correlation matrix diagnostics indicated no problems for any of the variables/factors with the exception of collaboration. University

collaboration was skewed and the diagnostics could be improved. However, given the relatively normal distributions and the large sample size, using standard orthogonal factor analysis is justified. All survey questions and factor analytic output are available from the authors upon request.

Table 2: Descriptive Statistics

Variable	Mean	Std Dev	Min	Max
Delay (in days)	97.88	171.89	-408.00	690.00
Censored	0.79	0.41	0.00	1.00
External Assistance in Application	1.95	2.55	0.00	17.00
Citizen Participation in Application	0.89	1.05	0.00	4.00
Copied Policies from Other Government	0.89	1.09	0.00	3.00
Media Involvement	1.85	1.60	0.00	5.00
Innovative (New) Policies to Implement	0.25	0.43	0.00	1.00
Citizen Advocacy Level	2.96	0.75	1.00	4.00
Number of Prior Sustainable Policies	2.04	1.96	0.00	7.00
Count of Green Practices	2.16	1.27	1.00	5.00
Satisfaction with Approval Process	5.65	2.38	1.00	10.00
Satisfaction with Disbursement Process	5.81	2.48	1.00	10.00
Satisfaction with Overall Process	6.64	2.22	1.00	10.00
Green Development as Economic Development Tool	6.73	2.13	1.00	10.00
Percent At-Large Representation	0.65	0.40	0.00	1.00
City Manager Form of Government	0.74	0.44	0.00	1.00
Ideology of City Council	5.81	2.29	1.00	11.00
Green Development as Economic Development Tool	0.14	1.01	-2.96	1.78
Green Development in Planning	0.05	0.97	-2.19	2.40
Goal Agreement	0.08	0.93	-2.59	1.67
Obstacles from DOE	0.11	1.01	-1.48	2.33
Obstacles from Other Federal Agencies	0.03	0.99	-1.18	2.72
Obstacles from Local Organizations	0.00	0.99	-0.83	3.87
Obstacles from Administrative Capacity	0.11	0.98	-1.56	2.70
Collaboration within Region	0.09	0.99	-1.41	2.12
Collaboration with State/Federal	0.08	0.99	-1.46	2.60
Unemployment	9.12	2.22	2.70	17.00
2009 Population	1370162	2111982	11380	9848011
Education	27.25	8.47	9.10	54.60
Population Density	1317.09	1706.65	0.40	11691.60
Grant Size Per Capita	0.56	1.04	0.00	17.92

Model

The dependent variable is the time between approved start dates and actual start dates. Some localities have yet to begin their EECBG projects, so they are right censored. Since we are

measuring time until an event with right censored data, a survival model is the appropriate statistical tool to employ.

The choice of a survival model is not solely based on the fact the dependent variable is the time to adoption. Hazard models also provide simple mechanisms for dealing with truncation and censoring. Censoring occurs when we have incomplete information on an observation and is a form of missing data. In survival analysis, the most common form of this is observations that have not had an event at the end of the study, which is the case in this study.

The vast majority of political science literature, particularly in policy adoption, uses simple event history analysis and, most frequently, with a probit link function. For both statistical and theoretical reasons, we employ a frailty term in our survival model in order to adjust for unobserved heterogeneity and clustering in our analysis (Vaupel, Manton, & Stallard, 1979). Standard event history analysis considers the hazard rate of adoption to be independent and constant across all individuals in the study (Cox, 1984; Hougaard, 1999; Kalbfleisch & Prentice, 2002). Frailty terms are used to adjust the hazard for grouped data in the form of repeated observations or clustered data such as people in the same family getting a particular disease. Failure to adjust for these differences can result in inaccurate standard errors and coefficient estimates may be understated. Frailty terms included in a hazard model are analogous to random intercepts on a mixed model because they operate under the same underlying theoretical purpose.

The key difference between a frailty term and a random intercept is that frailty terms are multiplicative while intercepts are additive. A Gamma prior distribution for the frailty term is most frequently used because of the wide diversity of shapes it can take on with different

parameterizations, although Gaussian is another common and more restrictive choice. The difference between models is clear in the equations below which use a proportional hazards model to demonstrate the differences. The frailty model must estimate two additional parameters and is conditional on group j, which may be repeated measures or clustering.

Standard model: $h_0(t|X,\theta,\beta) = h_0(t) + e^{\wedge}(X*\beta)$

Frailty model: $h_0(t|X,\theta,\beta,\eta,\omega_j) = h_0(t|\theta) + e^{\wedge}(X*\beta) * \omega_j$

where: $\omega_j \sim \text{Gamma}(1/\eta,1/\eta)$

Finally, the frailty model is estimated using Bayesian techniques. While the authors agree with Gill (2002) and Gelman (2004) concerning the theoretical advantages of Bayesian theory concerning the more realistic view of probability and the ability to include prior knowledge in the analysis, Bayesian survival analysis has some practical advantages that are beyond theoretical dispute. Mainly, Bayesian estimation allows for features of censoring to be estimated by considering them as extra unknown parameters and updating the other parameters as if all observations were observed (Klein, Goel, & North Atlantic Treaty Organization. Scientific Affairs Division, 1992), whereas in classical frequentist statistics the nature of the censoring mechanism is largely ignored. Our analysis is most concerned with the censored data points as they are the most delayed in spending stimulus funds from the EECBG program.

There are a large variety of frailty survival models. In fact, almost all parametric and semi-parametric can be extended to include a frailty term. (Parametric models such as accelerated failure time (AFT) regression assume a distribution for the hazard function, where as semi-parametric and non-parametric forms do not.) The most common frailty model builds

on the Cox proportional hazard model (Cox, 1972), which has a natural Bayesian extension to a frailty model (Sinha & Dey, 1997; Sinha, Ibrahim, & Chen, 2003). The literature on Bayesian Frailty model has moved beyond the Cox regression model in both repeated events (Sinha, Maiti, Ibrahim, & Ouyang, 2008) and also grouped frailty terms (Yin & Ibrahim, 2005a, b), but the Cox model remains the benchmark to which other models are compared in survival analysis. An important point is that the inclusion of a frailty term or time varying coefficients by definition violates the standard proportionality assumption in the original Cox regression. The altered specifications of the Cox model are more accurately described as a semi-parametric relative risk model, which fails to imply any assumptions. We use a relative risk model in this analysis.

Results

We run a standard relative risk model with a gamma distributed frailty term clustering on city for this analysis. The model had a burn-in of 10,000 iterations and ran for an additional 50,000 before convergence was diagnosed. The Gelman-Rubin diagnostic along with trace plots indicated no signs of non-convergence. The results from the frailty survival model are presented in Table 3.

These results are preliminary since some of the data has not been coded as of the writing of this paper. The variables that are significant at the .05 significance level are highlighted. Please remember that negative signs indicate shorter delays.

Table 3: Frailty Survival Model Results for Predicting EECBG Implementation Delay

Variable	Estimate	SE	Lower	Upper
External Assistance in Application	0.024	0.018	-0.012	0.060
Citizen Participation in Application	-0.070	0.050	-0.169	0.029
Copied Policies from Other Government	0.066	0.042	-0.016	0.147
Media Involvement	-0.060	0.030	-0.118	-0.002
Innovative (New) Policies to Implement	0.054	0.091	-0.124	0.233
Citizen Advocacy Level	-0.008	0.057	-0.120	0.105
Number of Prior Sustainable Policies	-0.022	0.025	-0.070	0.026
Count of Green Practices	0.043	0.039	-0.033	0.119
Satisfaction with DOE Application Process	-0.055	0.022	-0.099	-0.011
Satisfaction with DOE Approval Process	0.017	0.021	-0.024	0.058
Satisfaction with DOE Technical Support	-0.083	0.023	-0.128	-0.037
Percent At-Large Representation	-0.190	0.094	-0.374	-0.006
City Manager Form of Government	0.082	0.081	-0.077	0.242
Ideology of City Council	0.005	0.019	-0.033	0.043
Green Development as Economic Development Tool	0.134	0.053	0.030	0.239
Green Development in Planning	-0.039	0.048	-0.134	0.055
Goal Agreement	0.004	0.052	-0.097	0.105
Obstacles from DOE	0.025	0.052	-0.078	0.128
Obstacles from Other Federal Agencies	0.025	0.048	-0.069	0.119
Obstacles from Local Organizations	0.028	0.053	-0.079	0.136
Obstacles from Administrative Capacity	-0.008	0.050	-0.108	0.091
Collaboration within Region	0.016	0.054	-0.092	0.124
Collaboration with State/Federal	-0.097	0.050	-0.195	0.000
Unemployment	0.026	0.017	-0.008	0.060
2009 Population	0.000	0.000	0.000	0.000
Education	0.004	0.006	-0.008	0.015
Population Density	0.000	0.000	0.000	0.000
Grant Size Per Capita	0.006	0.033	-0.058	0.070
Clean Energy Policy	0.279	0.117	0.050	0.509
Financial Incentives for Energy Efficiency and Other Covered Investments	0.094	0.154	-0.209	0.396
Government, School, Institutional Procurement	-0.019	0.125	-0.263	0.225
Loans and Grants	-0.010	0.146	-0.296	0.277
Renewable Energy Market Development	-0.098	0.134	-0.361	0.164
Technical Assistance	0.269	0.097	0.079	0.459
Transportation	-0.177	0.092	-0.359	0.004
Workshops, Training, and Education	0.126	0.127	-0.123	0.376
Building Energy Audits	0.233	0.112	0.012	0.454
Other	0.201	0.101	0.003	0.399

The results provide strong results for the influence of grant management. Satisfaction with the application process and technical assistance are significant and in the hypothesized direction. Inconclusive results were found for satisfaction with the approval process.

District versus at-large representation was the only political institution to achieve significance in the model. Collaboration with universities, states, and federal agencies other than DOE was found to significantly shorten delays in implementation. All of the additional hypotheses have inconclusive findings.

Several control variables were also significant. Cities which promote sustainability for economic development purposes were more likely to spend funds expeditiously. Additionally, cities which actively promoted sustainability efforts in the media were more likely to spend funds on time. Finally, the type of EECBG program for five of the ten dummy variables was significant. (The coefficients are all in comparison to 'Building Retrofits' which is the excluded group.)

Discussion and Conclusion

The intent of this research was to develop and test a theory of compliance in single-shot games. The EECBG program provides an ample testing ground as it was a large, one-time investment between a principal and an agent who had no previous working relationship. We build on previous theories of fiscal federalism which focus on repeated games to develop a framework for single-shot games. Carrying over the importance of goal agreement and political institutions from previous studies, we add insights from P&W's classic work to suggest that grant administration and resource dependency have strong effects on the ability of single shot-

programs to achieve compliance. We test our theory using a relative risk model with a frailty term and find that grant management, political institutions, and collaboration all have significant impacts on predicting implementation delay.

The use of delay as a dependent variable in itself is a theoretical contribution. While P&W stressed the importance of timeliness in implementation, scholars have largely neglected the impact of delay on actual and perceived performance. Single-shot grants are more likely to be stimulative and in some rare cases quickly spending the money can be almost as important as where the money is spent. Even when speed is less of a primary goal, the timely dispersal of funds is necessary to accomplish program goals. This research provides some groundwork for further exploration of delay as a policy goal. Policy-makers could immensely benefit from academic research into what systems can produce the quickest bang-for-the-buck.

The most robust set of findings are from our analysis of the grant management variables. Satisfaction with both the application process and technical assistance are shown to reduce delays in implementation. Previous research has shown that monitoring produces compliance in spending but has overlooked other aspects of grant management. Achieving compliance through monitoring in single-shot grants is not an optimal solution, so increased preparation and involvement on the front end of the principal-agent relationship must overcome this limitation. While agent satisfaction is a prudent proxy for quality of grant management, there is ample room for improved theory and measurement on the subject. The link between effective grant management and performance represents a lacuna which public management scholarship has yet to fill.

A second dearth this analysis tries to fill is the lack of theorizing about the role of political institutions in fiscal federalism research. The finding that at-large representation is associated with goal compliance fits in with previous studies which report district representation favoring policies with geographically limited benefits. We intend to extend this research by attempting to categorize the different energy policy choices into classifications based on the distribution of their outcomes and then examining our district representation finding at a disaggregated level.

The third significant finding from this work is that collaboration with universities, states, and federal agencies other than the DOE decreased the amount of delay in EECBG grants. The finding is possibly more surprising considering that collaboration with surrounding entities had no distinguishable effect. Cities appear to be gathering information from vertical and not horizontal diffusion. This may be a result of the technical nature of energy policy and the lack of previous experience on the part of local governments. Few governments had sustainability plans before the ARRA and even fewer had the technical expertise to handle complex energy policy decisions. That expertise was housed in research institutions and higher levels of government, therefore local governments were forced to look upward and not within their fellow ranks.

Several hypotheses resulted in inconclusive findings. Of these, the most unexpected was the failure of goal agreement to achieve significance. Goal agreement has been found to be a robust predictor of grant compliance in several studies on repeated games and was theorized to have greater importance in single shot-games. This was the first time goal agreement's impact was measured on single-shot grants, in predicting delay, and using a more direct

measure. Further study is necessary to detangle why goal agreement has been a consistent predictor in previous studies of grants and is not in this dataset.

This research is the beginning of a vast research agenda investigating EECBG programs across the nation. We initialized this endeavor with a study of delay because it is one of the most publicized criticisms of the stimulus and because it has received scant research in the literature. However, we intend to extend this analysis to more classical measures of goal compliance to see if effective grant management also impacts spending. Once all of the projects have been started in the next year, we plan on measuring the performance of these programs from objective outcomes, such as green jobs, and not simply self-reported measures.

Appendix A: Factor Analysis Information

	Communality		
	Label	Question	Factor Pattern
Economic Development	0.6035		
	q0017_0001	Promoting sustainability will attract business and investment.	.861
	q0017_0002	Sustainability programs put a city at a competitive disadvantage in promoting economic development.	-.6091
	q0017_0007	Energy efficiency and attracting "green business" is important to our city's economic development strategy.	.836
Planning	0.7509		
	q0017_0004	Our city's planning documents explicitly address energy efficiency issues.	.8604
	q0017_0005	Our city's planning documents explicitly address energy production issues.	.874
	q0017_0006	Our city's planning documents explicitly address climate change issues.	.8652
Goal Agreement	0.693		
	q0010_0001	Greenhouse gas reduction	.8371
	q0010_0005	Green job creation	.8331
	q0010_0004	More sustainable community	.8271
DOE Obstructions	62.46		
	q0022_0001	Buy American provisions	.8015
	q0022_0003	Davis-Bacon labor requirements	.8377
	q0022_0006	Federal reporting requirements (Fedreporting.gov)	.7276
EPA Obstructions	0.719		
	q0022_0002	Environmental impact statements (NEPA requirements)	.8303
	q0022_0004	Historic Preservation requirements	.862
	q0022_0005	New EPA lead rules	.8513
Local Obstructions	0.7392		
	q0022_0014	Lack of community support or awareness	.8769
	q0022_0015	Lack of support from private sector	.9297
	q0022_0016	Lack of support from nonprofit sector	.9162
	q0022_0017	Opposition from community based groups or organizations	.6959
Administrative Obstructions	0.6212		

	q0022_0011	Lack of staff capacity	.7764
	q0022_0012	Lack of informational resources	.7783
	q0022_0013	Time provided for implementation	.8093
Regional Collaboration	0.7832		
	q0026_0001	Other cities within your county	.9189
	q0026_0002	Cities within the region or metro area	.9279
	q0026_0008	Regional organizations or partnerships	.8027
Federal/State Collaboration	0.6572		
	q0026_0003	Universities	.7685
	q0026_0004	State agencies	.8284
	q0026_0005	Federal agencies other than DOE	.8335
Interest Group Support	0.6412		
	q0029_0002	Neighborhood Organizations	.7249
	q0029_0004	Real Estate Developers	.8275
	q0029_0005	Homeowner Associations	.8279
	q0029_0006	Local Business	.8181
Government Support	0.6193		
	q0029_0009	City Council/Commission	.794
	q0029_0010	State Government	.7676
	q0029_0011	Economic Development/Planning Depts.	.7989

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