State Constraints and Local Environmental Programs:

Solid Waste Management Policy Instrument Choice

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Prepared for the Midwest Political Science Association meeting in Chicago, April 19-21, 2001

* I would like to thank Dr. Richard Feiock for the useful comments and suggestions and the Portuguese American Foundation for Development (FLAD) and the DeVoe Moore Center for the financial support. Any mistakes are obviously my own responsibility.

Background

Solid waste policy decisions are concentrated at the local government level. Nevertheless, state level governments have played a significant role in framing solid waste options at the local level. In the 1960s and 1970s the involvement of state (and federal) level(s) of government became seen as necessary based on the idea that the solid waste management problem was too difficult to be managed single-handedly by local governments because of excessive costs in collection, handling, and disposal of solid wastes (Luton, 1996). Since the 1980s, states have mandated recycling, established recycling goals and minimum requirements, adopted strategic plans, provided incentives to recycle and source reduction in the form of grant money, promoted more restrictive landfill requirements, and stimulated the creation and competition in markets for recyclables (Khator, 1993). All these decisions at the state level are important in influencing the solid waste policy choices dominant in each state. This provides the motivation for this empirical analysis which concentrates upon the determinants of state solid waste policy choices rather than a national level analysis.

The supply of solid waste policies is decided by state executive and legislative decision-makers. This paper discusses the decision of state elected officials to direct local solid waste policies using a political economy approach where these decisions result from both the political benefits captured by them as suppliers (Feiock and Stream, 1998) and economic trade-offs between policies. With this approach I expect to shed some light on the reason why, during the 1990s, local solid waste policy evolved away from landfills towards environmentally friendlier alternatives.

This project uses local level data aggregated at the state level and it is pooled across the fifty American states and time (1991-1999). The choice of time period is constrained by the lack of systematic data for solid waste management before the 1990s. Testing different aspects of state solid waste policy is made difficult by the lack of consistency in the available data. Nevertheless, it is possible to identify the recycling goals legislated (or not) by the 50 states throughout the time period chosen.

Introduction and Historical Perspective[1]

Solid waste management combines characteristics of regulatory and distributive policy and its relevance grew with the large increase in amounts of industrial and domestic waste generated by mass consumption society, especially after the 1950s. Historically, individuals and families have had primary responsibility in collecting and disposing of solid waste, which was essentially composed of organic materials that could be burned for fuel, used as crop fertilizer, or fed to livestock. To be more accurate, until the beginning of the twentieth century, the role of municipal governments in managing waste was virtually nonexistent.

The state of affairs begins to change in the late nineteenth century, in large part due to the extraordinary population growth of American cities as a consequence of industrialization. Concomitantly, scientific knowledge at the time considered contagious diseases a consequence of gases emanating from dejects and urged massive efforts to clean American cities. When germ theory was developed in the beginning of the twentieth century, communities were already aware of the need for cleanliness and sanitation as a means of assuring public health.

With the advent of germ theory, solid waste management stops being simply a matter of public health and becomes a technical and administrative issue. This provides the background for the development of an increased role of sanitary engineers under the argument that solid waste collection and disposal should be run by neutral experts, above the interference of local politics. Not incidentally, this is also the time of the Progressive reform movement.

It was the hope of these sanitary engineers to help localities to find a "one best way" to manage waste. Even though there was an agreement upon avoiding, at all cost, dumping on open land or water, open burning, and using untreated wastes as landfill, it wasn't clear which of the remaining alternatives – filling, burial, plowing, and incineration – was preferable and how they might be combined by each municipality.

[1] This section borrows heavily from Luton (1996: 88-96).

Most of the reuse schemes attempted during the twentieth century failed due to their incapacity to be economically viable in comparison to sanitary landfill. And although the sanitary engineering departments were insulated from political interference, the contracts for solid waste collection and disposal were often attributed by personal and political favor.

Dumping and landfilling became the dominant forms of managing solid waste, but the lack of clear criteria defining what a "sanitary landfill" should be allowed the prevalence of traditional land dumps as the primary method of disposal and created increasing environmental pollution problems.

The solid waste crisis of the 1970s and 1980s is a consequence of the large increase in the amounts of per capita production of waste and of the change in the composition of the waste, with paper and plastic replacing horse manure and ashes as the most significant portions of municipal solid waste.

(Table I about here)

The problems resulting from solid waste became too large and complex to be dealt by municipal governments alone. It is by the mid-1960s that we begin to see intervention by the federal and state governments in a number of forms. A detailed analysis of the role of state governments is made in the next section. At this point I concentrate the analysis on the role of the federal government.

The first piece of federal legislation dealing with solid waste was the Solid Waste Disposal Act of 1965, amended in 1970 by the Resource and Recovery Act (RRA). The major goal was to improve the methods of solid waste disposal by providing technical and financial assistance to stimulate alternatives to open burning and the legislation allowed the federal government to be involved in the research and development of new solid waste technologies (Luton, 1996; EPA, 1989). In 1976 another set of amendments was adopted under the name of Resource Conservation and Recovery Act (RCRA). The 1976 amendments prohibit new open dumps and close or upgrade existing ones and allowed local governments to contract with private corporations for resource recovery facilities (Luton, 1996).

In 1979 the EPA approved another set of guidelines for state solid waste management plans aiming at involving the public, reducing air and water pollution resulting from solid waste disposal, and promoting environmentally safe disposal of wastes. Solid waste facilities and practices should avoid interference with flood plains, contamination of groundwater, and disturbance of endangered species.

The 1984 amendments to the RCRA made the technical standards for the operation of solid waste disposal facilities more stringent. Higher standards in the operation of landfills were set and states were encouraged to meet EPA's expectations.

Probably the most well-known set of guidelines of the Federal government to states is the one suggesting a hierarchy of approaches approved in September of 1988: waste reduction, recycling, incineration, and landfilling in decreasing order as environmentally preferred alternatives. This is consistent with the need for an integrated approach to the solid waste problem recognized by sanitary engineers in the beginning of the twentieth century. Moreover, it confirms the need to identify the specific characteristics of the city, county, region, or state, the types and quantities of solid waste, and social, political, and organizational factors in order to manage waste accordingly (Luton, 1996). The 1988 guidelines also set national goals of 25% waste reduction in waste generated, 25% recycling rate, and 20% of the remaining waste sent to waste-to-energy facilities by September 1992.

Landfill standards revised in the beginning of the 1990s focused upon acceptable location, design of new and existing landfills, established closure and post-closure care standards, imposed the use of double liners of flexible materials, and mandated the use of leachate collection systems (Steuteville and Goldstein, 1993).

The RCRA Subtitle D legislation operates in a regime of partial preemption, that is, it establishes minimum regulatory requirements that states should comply to. Federal interference in the development and implementation of state programs should only occur if states fail to comply with these minimum standards (EPA, 1989; Luton, 1996).

Theoretical Framework

The theoretical framework employed to explain state solid waste policy is a political economy approach. In areas traditionally under the responsibility of local governments, state policy can be justified as a way of reducing economic and political transaction costs in search of both economic and political efficiency. This section begins by explaining state policy intervention as a means to correct local market failures and justifies policy instrument choice as a result of purely economic trade-offs. The second part argues that the choices of decision-makers are not framed within economic criteria alone. In fact, the choice between landfilling, incineration, recycling, and source reduction has both political and distributive consequences that, I shall argue, have an equal or even more relevant impact upon policymaking.

Economic Transaction Costs

The decision faced by state governments is one along a continuum between vertical integration and complete delegation of solid waste policy. The first solution is one of total centralization, with the state government responsible for writing and implementing solid waste policy without any input or discretion left to the localities. This alternative implies the existence of a single hierarchical structure at the state level but it is not reasonable since it becomes too centralized, costly, and inflexible to handle the thousands of decisions to be made. Coordination of the subunits representing the local governments in this hierarchy would be very complex and difficult to achieve.

The second solution is complete delegation (nonintervention), emphasizing policy adoption at the local level, where the local governments are free to select the governance structure for each policy area that minimizes local transaction costs. If local governments make decisions concerning certain policy areas without federal or state level guidance they are operating in an economic free market of sorts. In this local market, transaction costs are present in several forms, usually under the general label of market failures. When this happens, policy intervention by the state would leave the jurisdiction as a

whole better off by adopting policies consistent with the preferences of the state median voter.

Ultimately, the relationship between state and local governments fits within these two ideal types. The decision regarding the degree of centralization/decentralization is determined by the amount of economic and political transaction costs involved in the exchange. The problem is then to determine if and when should state legislators intervene in local policy choices. In a certain sense, this situation is not new. The option between Montesquieu's confederate republic and Madison's compound republic was a choice between having a decentralized alliance of city-states and having a centralized federal government. Ultimately, Madison's idea prevailed *albeit* with an economic argument that city-states better serve the "local and particular" (Inman and Rubinfeld, 1997).

The argument for state intervention can be justified in Coasian terms. Just like Coase (1937) proposed that certain market transactions involving large negotiation costs should be integrated under the hierarchy of the firm, it can be argued that, due to inefficiencies in local policy making and choice, state action is necessary to reduce transaction costs and achieve more efficient solutions. In the case of local market transactions, the costs of negotiation and market failure correction may be too high so that state command-and-control or incentive based regulation is able to economize on these costs (Epstein and O'Halloran, 1999). However, state intervention also suffers from inefficiencies that result from the inability to establish/choose what is best for each individual community, excessive bureaucratization or implementation failures. The degree of intervention (contract features) becomes a matter of weighting the transaction costs experienced at the local level against the transaction costs experienced by the different hierarchical arrangements (contracts) between state and local governments. Moreover, the number of decisions concerning a specific policy can either be left to local governments (market) or can be centralized at the state level, when it has any extra-local impacts (hierarchy). Ultimately, decisions regarding urban growth, solid waste, economic development, or any other issues of interest to both state and local governments are to be made with this framework in mind. The fundamental questions are then why do states regulate local policy markets; and what is the contract between a state and its local governments that minimizes transaction costs?

In each state, legislators will choose the contract (legislation) that minimizes transaction costs, since they are not able to enter in individual agreements with each local government. As an example, one can easily argue that, certain policy issues cut across jurisdictions assuming a regional character and result in less than economic efficient allocations. When this occurs local policy choices/solutions may not be adopted due to collective action problems, generating a worse outcome for some jurisdictions in question and for the region as a whole and requiring state level regulation. Ideally, only local market inefficient transactions should be regulated to avoid the loss of local autonomy and choice and allow the capture of high-powered market incentives resulting from competition among local governments (Williamson, 1985; Frant, 1996). In practice, however, state legislators have political incentives to elaborate a contract that minimizes their political transaction costs and maximizes their chances of reelection.

Next, the different types of political transaction costs are discussed from a theoretical perspective and the trade-offs between centralization of policymaking at the state level and delegation to local governments that determine the boundaries of the relationship between state and local governments highlighted. The governance structure adopted in each particular instance will be the most attractive from the point of view of the median state legislator according to the logic of political efficiency (Epstein and O'Halloran, 1999).

Political Transaction Costs

In the preceding section, I argued that state legislators often regulate local policy markets in order to overcome inefficient transactions and allocations created by local government activity. However, it would be naïve to believe that state legislators are uniquely concerned with economic efficiency. In fact, state officials' goals are far more vast than efficiency and encompass, among others, reelection and subjective equity goals. Hence, when contracting with local governments, state legislators will write a contract that maximizes their reelection chances motivated by the logic of political efficiency and minimization of political transaction costs.

In the exchange between state and local governments, five major types of costs are usually present: agency costs, legislative decision-making costs, uncertainty costs, commitment costs, and sunk costs. Each type will be defined and its implications for the creation of intergovernmental rules discussed.

Agency Costs

States face agency problems because local governments are numerous and difficult to monitor in the implementation and enactment of state policy. Principal-agent relationships involve two major types of costs – adverse selection and moral hazard (Moe, 1984). First, principals face adverse selection costs because of the ex-ante information asymmetry present in the relationship between principals and agents. In their role of principals, state governments will elicit information from their agents (local governments), but only the agents have full knowledge of the information being required by the principals and can use this knowledge to their own advantage. Moreover, just like their state level counterparts, the local level officials behavior is shaped by the political business cycle and periodical elections. As argued previously, this might lead to less than efficient decisions, making state policy making an efficient intervention, at least potentially.

Second, moral hazard results from ex-post opportunistic behavior on the part of agents. Local government officials may respect the letter of the law while attempting to escape legislators' intentions. As in the case of adverse selection, shirking or non-compliant behavior results from information asymmetry favoring the agents.

State level mandates transmit information to local governments regarding the preferences of the state government enacting the legislation. In order to minimize the transaction costs incurred in the contract two types of mechanisms can be typically relied upon: external and/or internal controls. On one hand, to reduce the costs incurred by adverse selection and moral hazard, the principals (state governments) devise incentive structures and sanctions (external controls) that can prompt the agents (local governments) to perform according to the principals' expectations, which in this case would mean to comply with the letter and intention of the approved state laws. On the

other hand, principals can also achieve the cooperation of the agents using internal controls such as trust, credible commitments, and cooperation between the two levels of government. Internal controls rely more on social and moral commitment and reputation, and opportunities for reduction of conflict.

Legislative Opportunity costs

The exchange between state and local governments involves distinct preferences. States may want to direct or limit local choices, whereas localities want discretion or, at least, state support (financial and/or technical) when implementing a contract.

When enacting a piece of legislation, state legislators face legislative opportunity costs (Horn, 1995). A detailed contract involves more time and effort spent in carving the specific piece of legislation than contracts allowing for discretion of local level governments in its implementation.

Several types of opportunity costs can be identified. Here we concentrate upon two of these: financial and time/agenda constraints. Financial opportunity costs derive from budget constraints and limitations. The fiscal capacity of state and local governments determine the range of policy alternatives that can be adopted and constrain the financial incentives that can be attributed in order to direct individual behavior.

There are many issues that can be addressed by elected officials at a given point in time. Because officials face these pressures upon their time, their agenda reflects the choice of a set of issues to consider in detriment of others. In order to include a new issue, another has to be dropped. Not only the number of issues that can be addressed at one point in time is limited but also the longer legislators spend on a specific piece of legislation, the less time will be available to introduce other legislation (Horn, 1995).

In terms of legislative costs (time, effort and money) I posit that a strict detailed mandate will be more costly to implement than a more vague piece of legislation. Moreover, when detailed contracts are approved, the implementation and the results at the local level will mirror more closely the preferences of the state legislature than if the contract is vague in its content.

Uncertainty Costs

When a contract is approved, it may be difficult for each local government within a state to determine how it will be affected by that piece of legislation. Contracts entail financial and technical consequences for local governments and may exacerbate conflicts between local groups with different preferences. The degree of support for a contract then depends upon a third set of political transaction costs – uncertainty costs (Horn, 1995). If local level preferences are aligned with the goals of state legislation, we can expect a high degree of support for the contract at the local level, independently of the contract features (Jenks, 1994). As a consequence, uncertainty costs affecting state legislators will be low. When local governments face fiscal pressures, lack the technical competence or face local opposition, contract implementation may entail large uncertainty costs for state legislators. With this in mind, the implementation of the contract is expected to vary according to state legislators' preferences and individual local contexts.

The approval of a piece of legislation by state legislatures does not guarantee its automatic implementation. In order to implement a contract several enforcement strategies can be adopted. Typically, authors identify three types of strategies: coercive (command-and-control), cooperative (incentive-based), and mixed strategies (Burby and Paterson, 1993; Jenks, 1994). The coalition enacting the mandate at the state level may rely on one or more of these strategies in order to minimize the uncertainty costs resulting from implementation.

Commitment Costs

Once the enacting coalition changes, there is no guarantee that the same enforcement strategy will be followed, with the same degree of stringency, or that the commitment to the contract will persist. This commitment problem affects local governments because it makes uncertain the flow of intergovernmental transfers in terms of financial and technical assistance. Hence, commitment costs will be smaller in local governments better equipped to deal with the mandate and higher in communities more dependent of

intergovernmental assistance because these communities demand more from state governments in order to respect the terms of the contract.

When designing a contract state governments will attempt to minimize commitment costs by including provisions that safeguard future attempts to renege on the contract. From the perspective of the state legislator, commitment costs can be minimized by securing an agreement that creates a "stable structure of exchange" (North, 1990: 50) both over space and time. In this fashion, state legislators are able to control part of the commitment problem, even if, ultimately, commitment costs depend on local governments' perception of state legislators' actions.

Sunk Costs and Path Dependency

Finally, the approval of mandates by state legislators and their enforcement by state agencies also faces sunk costs arising due to path dependency. The idea of path dependency affecting local policy choices will be discussed further ahead but, for now, it is important to understand the state's perspective. An example should illustrate this idea. The success in the enforcement of an unfunded mandate is largely dependent on early and current practices at the local level. If a state mandates a recycling goal of 25% to be achieved in 2 years by all localities within the state, communities already recycling at or close to that level are more likely to obey the mandate than communities with very low recycling rates. Although this seems to be an obvious statement, the implications are extremely important in terms of cost of compliance since local governments that made the "wrong" choice of relying heavily on landfilling and/or incineration will find it harder to comply than localities opting for recycling and source reduction early on. This example highlights the importance of making the "right" choice early on and points to the costs incurred by states in redirecting local governments' policies.

Summary

Given the existence of political transaction costs in the relationship between states and localities, why would states be interested in entrusting local governments with policy

activity? Epstein and O'Halloran (1999) argue that delegation helps states to reduce their workload, to take advantage of local agency expertise and proximity to the problems, and to avoid inefficiencies arising from over centralization usually known as influence costs such as delays, logrolling, and information inefficiencies (Milgrom and Roberts, 1990).

This section presented the political transaction costs that justify state action in policy areas previously under the exclusive responsibility of local governments. State legislators act so as to minimize political transaction costs and having political efficiency (reelection) as the ultimate goal. As the next section will confirm, political transaction costs can also be an opportunity for individual legislators and elected officials to further their political careers, interests, and ideology.

Political Benefits and Ideological Costs

The previous section depicted state policy adoption as a consequence of political transaction costs. This section explores some additional factors affecting the motivation of individual state legislators and discusses two sets of reasons linked with election cycles and ideological and personal preferences that help to explain why individual suppliers make the choices they make (Feiock and Stream, 1998). Even though these factors are not traditionally thought off as political transaction costs, they will be addressed as such.

Policy decisions on the part of legislators or local officials entail, more often than not, political benefits and costs. Elected officials have high-powered incentives (reelection) to respond to specific constituencies operating at the local level. Based on this assumption one can expect that, *ceteris paribus*, officials will support policies that are supported by the median voter.

Probably even more important than the general public, the role played by interest groups in the policy area in question is relevant for the choices made by elected officials. The degree of competition between interest groups and their influence and the selective benefits to be ripped will affect the power of each interest group and, in turn, affect the policy choices made by elected officials. It is worth noting that the importance of interest group activity in particular and public opinion in general will vary according to the

visibility of the policies being enacted and to the moment of the electoral cycle when the decision is made.

Elected officials have short time horizons which make them overvalue current benefits and costs and dismiss or undervalue long-run benefits and costs. Hence, election proximity affects policy choice and adoption because officials involved may feel the need to adopt more popular policies in order to accomplish reelection goals. This is even more noticeable when the election is highly competitive. The argument here developed is one of the political business cycle applied to the state level of government. In election years, the role of political benefits becomes crucial with officials seeking the adoption of policies with visible, immediate, and directly traceable benefits, and with costs that can be deferred in to the future. In addition, when choosing between competing policy alternatives, elected officials weight the political benefits accruing from satisfying competing demands made by citizens and interest groups.

When making policy decisions, elected officials are expected to behave consistently with their ideology and personnel preference. Everything else equal, it is expected that Democrats will support more spending and pro-active environmental policies than Republicans.

In certain situations one can expect that elected officials experience ideological costs. This fact is more prevalent in election years. The desire of politicians to please the electorate by adopting what is perceived as "good" policy may force them to sacrifice some of their ideological convictions. Knowing what policies are favored or opposed by the median voter may help elected officials to enhance the probability of reelection and explains, at least partly, why, in certain occasions, elected officials vote against their ideological beliefs.

The Theoretical Framework Applied to Solid Waste Management Policy

The framework presented has the potential to be applied to several policy areas, including solid waste management, growth and land use management, economic development, among others. In this paper I develop a first test of part of the framework. To that intent, I take the legislated state recycling goals as the dependent variable in order

to determine how these goals are chosen and what factors influence the decision of state legislators to be more or less stringent. In future work, I expect to develop other tests related to other characteristics of state solid waste policies, namely the types of mandates and incentives.

Solid Waste Management as a Production Technology Choice

The economic explanation argues that the choice involves comparisons of benefits and costs of each of the alternative management technologies or policy instruments – landfilling, incineration, recycling, and waste reduction. These options are compared in terms of their marginal benefits, that is, how well they contribute to the disposal of wastes and to the minimization of negative externalities. The benefits are analyzed in relation to their unit costs. In other words, based upon economic reasoning alone, the waste management benefits of the median taxpayer are maximized by the available production technology which maximizes the benefits of waste disposal and minimizes the negative externalities at the least cost. Besides discussing solid waste management as a production technology choice, this section also reviews the relevant literature.

Using this approach there are two types of benefits that can result from solid waste management tools (production technologies) – disposal of wastes and mitigation of negative externalities. The first type of benefits can be seen as constant across production technologies, meaning that landfilling, incineration, recycling and source reduction are equally effective in dealing with the problem of disposal. The choice between production technologies is based upon the minimization of producer-to-consumer negative externalities. This is the second type of benefits that have to be especially considered. Health risks, contamination risks, and reduction of property values are some of the negative valued impacts that affect the community that did not fully consent to them (Weimer and Vining, 1992).

The capacity of local landfills affects the choice of production technology. Peretz (1990) argued that communities facing lack of landfill capacity face pressures to look for alternatives to solve the solid waste management problem. The availability of suitable land for future landfilling also influences the choice of production technology. Overall,

low landfill capacity will tend to increase negative externalities. Furthermore, the health and contamination safeguards involved in each choice will also affect the presence of negative externalities.

The costs involved in the management of solid waste also vary across production technologies. Hence, the choice between alternatives depends largely upon the comparison of costs of different production technologies.

The costs of recycling depend upon the participation levels, economies of scale, and external markets for recyclables. First, increases in participation levels reduce the unit cost of recycling due to economies of scale. As the costs of recycling decrease, a substitution effect occurs, with the governments replacing landfilling or incineration with more and larger recycling programs (Fisher, 1996). Furthermore, state level funding may affect the pattern of solid waste management choice because it makes municipalities better-off – income effect – simultaneously altering individual behavior.

A similar mechanism is thought to occur when the population of a jurisdiction increases. The size of the population has been analyzed under the rationale that, as the population increases, the amount and diversity of recyclable materials also increases creating the need for solid waste programs larger in scope. Again, according to our waste management explanation, the costs of recycling programs will go down as the population gets larger, which allows for recycling programs larger in scope (Paehlke, 1993). In their 1993 study, Feiock and West also found population to be a positively significant predictor of the adoption of municipal solid waste recycling programs, both in the need/responsive model and in the final model.

Additionally, the existence and degree of development of external markets for recyclables affects the cost of recycling. Paehlke (1993) argues that economic growth is not incompatible with recycling as long as there is a market for recyclables. The stability, certainty, and equilibrium of this market are decisive to achieve an integrated waste management. McClain (1995) discusses the some of the problems most frequently reported with a market for recyclables. On the supply side, the author argues that producers are reluctant to invest in manufacturing technologies that employ recyclables due to the uncertainty in the supply of materials. On the demand side, communities hesitate in investing in the collection of materials because of the volatility of prices and

revenues. As a result, McClain argues, a vicious cycle is in place and it is only broken if strong incentives are provided to both sides of the market. Accordingly, while landfill capacity is adequate and costs of landfilling kept low, recycling programs will either not be enacted or present small scope.

The costs of landfilling depend upon the availability and capacity of landfills and the cost of regulation. Negative externalities are very often addressed through command-and-control regulation such as liners for landfills. More stringent landfill regulation increases the costs of landfilling comparatively to recycling (McClain, 1995).

In jurisdictions where there is a shortage of landfill capacity, the costs and negative externalities associated with landfilling are high, leading to increases in the scope of recycling programs. Additionally, state government level mandates, intergovernmental financial assistance, and general tax revenue to finance the recycling programs alter the benefit/cost ratio of recycling relative to other alternatives. These may constitute the incentives that help to break the vicious cycle described by McClain (1995).

State level mandates, especially if associated with grants, are likely to reduce the relative cost of recycling when compared to other available alternatives and, for this reason, encourage broader recycling programs. Feiock and West (1993) found that state level mandates and intergovernmental financial assistance are significant predictors of the adoption of residential curbside programs. If reduction goals are included in state legislation, municipalities have an incentive to make the programs as large in scope as possible. Adopting curbside pick-up will help municipalities to achieve those mandated goals because, *ceteris paribus*, the increased convenience will augment citizen participation.

Several researchers have tried to establish the consequences of adopting unit based pricing programs to reduce waste generation, either using case study approaches and quasi-experimental designs (Callan and Thomas, 1997; Nestor and Podolsky, 1998; Fullerton and Kinnaman, 1996; Van Houtven and Morris, 1999) or national level data (Kinnaman and Fullerton, 1998; Jenkins et. al. 2000). The fourth solution to solid waste management – waste reduction – has proven difficult to implement on a large scale due to technological limitations and the radical behavioral change required (Peretz, 1990),

nonetheless the number of source reduction programs has been growing nation-wide and 47 states are currently involved in this type of activity (EPA, 1998).

When flat-fees are adopted in solid waste management, households do not have an incentive to economize on waste generation and disposal, since the marginal price for each additional pound/container of garbage is zero. Because households maximize their utility subject to a budget, unit pricing programs that place non-zero marginal price on waste disposal lead to reductions in waste generated and increases in recycling (Jenkins et. al. 2000). However, these two positive consequences, one direct and the other indirect, are challenged by arguments of illegal disposal (burning or dumping) to avoid paying the marginal price (Fullerton and Kinnaman, 1996). Either way, the adoption of unit based pricing assumes that waste generators acknowledge the relative costs of disposal each option entails and rationally choose the least cost option (Callan and Thomas, 1997).

Jenkins et. al. (2000) found that, as an incentive to recycle, unit pricing is ineffective. According to the authors there are two possible reasons. First, the average price of disposal in the sample is too low to generate a change in behavior of relatively high-income households. Second, a direct impact on waste disposal might be occurring. These findings are supported by previous research (Fullerton and Kinnaman, 1996) that also concluded that unit pricing does not influence either recycling rates or participation rates. Other research contradicts the findings of Jenkins et. al. (2000). Callan and Thomas (1997) found that communities implementing a unit pricing system will have, on average, higher annual recycling rates. This effect is even stronger if the community also offers curbside recycling services. By imposing unit pricing and providing curbside recycling, communities are able to lower the relative costs of recycling (time and storage costs), thereby making recycling more attractive for individuals (Callan and Thomas, 1997; Jenkins et. al., 2000).

The impact of different unit-pricing program features on curbside recycling rates was addressed by Nestor and Podolsky (1998) in their case study of the City of Marietta, Georgia. The authors concluded that, for this particular case, a bag program increases recycling rates more than a subscription can program. This study was extended by Van Houtven and Morris (1999) who did not find systematic differences between the two programs in the same city. However, the authors concluded that the bag program caused

larger reductions in waste setouts (mixed and total waste) than the subscription can program. The authors concluded that the bag program produces savings for residents and social welfare increases. In general, this conclusion may not hold however, if we consider that, on one hand, it is based on a single case study and, on the other hand, the marginal cost of additional waste generated per month by a household depends upon the particular amount increased and the point at which this increase occurs. As a consequence, the program that maximizes household/individual welfare may vary depending upon the price structure of the two programs.

Similarly, incineration involves costs and negative externalities that are pondered when deciding the production technology to be employed. In general, we expect that as the costs of recycling decrease relative to incineration costs, the larger in scope the municipal recycling programs will be. In accordance, Everett (1989) shows with the New Jersey case that, lower costs of other available options can also contribute to smaller programs. On the other hand, the enactment of air pollution controls on incinerators is likely to increase the cost of adoption of this production technology and, by that, decrease the relative cost of other solid waste management options.

Variables and Indicators

Because landfilling and incineration are considered the policy alternatives entailing the higher costs in terms of negative externalities, it is expected that, as reliance in landfilling and incineration decreases, recycling and source reduction will become the preferred alternatives. Measures for the number of landfills, incinerators, and curbside recycling programs were obtained from the national survey conducted yearly by the *Biocycle* periodical for the period between 1990 and 1999[2]. Additional data was retrieved from the Green Index (1991).

Population density is expected to have a positive effect upon recycling goals since higher densities produce economies of scale making it less expensive to adopt curbside recycling programs to fulfill the goals established by states. States with higher densities are also expected to legislate higher recycling goals because increases in population also

[2] All *Biocycle* numbers are cited in the reference section.

increase the quantity and diversity of recyclable materials. Population density is measured in individuals per square mile and was obtained from the U.S Bureau of Census.

The amount of solid waste per capita in tons produced in each state in a given year is also included as a measure of need, since the commitment to recycling is likely to be larger in states with larger amount of solid waste generated per capita due to space and environmental constraints[3].

Solid Waste Policy Tools as Consumption Goods

The complementary explanation argues that the economic explanation fails to include political and environmental forces that affect the choice being made in each state (Peretz, 1990). According to this explanation, citizens, environmental interests, and federal and state government officials have preferences concerning the available alternatives, valuing them as consumption goods. The political transaction cost framework examines the choice among the distinct production technologies as a function of both economic and political costs and benefits.

The support for a specific policy instrument results from the willingness of legislators to supply it. Each individual legislator's political support supply function is determined by his/her ideological preferences, the proximity of elections, and the political transaction costs involved in supporting a specific policy instrument. The aggregate supply function is determined by the sum of each individual legislator's supply function measuring the degree of support for a policy instrument at a specific cost (Keohane, Revesz, and Stavins, 1998). In explaining a state's preference for a specific policy instrument I consider the interaction of the individual suppliers characteristics and the political transaction costs they face.

Citizens, environmental interest groups and entrepreneurs can affect the type and scope of the policy instruments adopted. Rather than a management alternative for implementing solid waste collection and disposal, each policy tool may be seen as a

consumption good directly valued by these actors in the community. This is because some residents have an ideological preference for a specific tool independent of the environmental effects of the programs for local waste problems.

Policy Instrument Choice and Political Benefits

State elected officials are utility maximizing individuals aiming at reelection and adopt policies consistent with this goal (Downs, 1957). Elections are for elected officials what profit is for private businesses – high-powered incentives (Williamson, 1985; Frant, 1996). From this point of view, source reduction and recycling policies are obviously attractive, because they represent what citizens *perceive* as "good public policy" (Feiock and Stream, 1998).

During the last three decades, we have witnessed organized environmental groups voicing their concerns about an "environmental crisis". In particular, the question of solid waste management seems to deserve special attention. If policy is a response to environmental need, we should expect to see greater reliance on prevention strategies in states where solid waste management constitutes a serious problem. Also, states relying more intensely upon landfilling and incineration facilities (waste-to-energy plants) probably do so because of lower costs (tipping fees) of these alternatives when compared to recycling or unit pricing programs. As a consequence, state legislators would feel less pressure to change emphasis in solid waste policy instruments.

In general, demand for recycling is expected to be high when cost savings can be realized, when it is consistent with community environmental values, and when it confers benefits to organized interest groups.

Citizens and environmentalists interested in solutions to solid waste management problems value recycling and unit-pricing programs more than alternative actions such as landfilling or incineration (West et al., 1992). Environmentalists perceive the sitting of new facilities as inherently bad regardless of the availability of land or the amount of risks involved (Cassidy and Luger, 1998).

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[3] Extremely high correlation between density and solid waste per square mile of territory and, consequently, strong multicollinearity did not allow us to include this variable as a measure of need. Solid waste per capita ends up being a good measure of need.

If the goals of the recycling programs are purely political, one can also expect to see the presence and influence of environmental support in a given municipality associated with recycling programs larger in scope (Feiock and West, 1993). Using county data, Mrozek (1990) concluded that pro-environmental voting was a statistically significant variable in predicting curbside pick-up adoption. Membership in an environmental group is also positively associated with the performance of recycling programs (Feiock and West, 1996).

Source reduction and recycling programs are an attractive solution because citizens and environmentalists interested in solutions to solid waste management problems value these prevention strategies more than landfilling or incineration. This is because these alternatives can present potential environmental and health risks (West et al., 1992). Finally, it appears to be clear that, as Everett (1989) demonstrated for the New Jersey case, the lower the costs of other available options, the less a state will rely on recycling. The inverse is also true. As an example, the 1991 EPA regulations on landfills combined with rising land prices contributed to triple the average tipping fee of landfills in 6 years (Fullerton and Kinnaman, 1996; Steuteville and Goldstein, 1993). Under these circumstances it is reasonable to expect changes in the preferred policy instrument(s) for solid waste management, and tests for these trade-offs will be developed.

The size and the amount spent by each organized environmental group are particularly relevant because the costs of lobbying activities can be spread among members making collective action feasible. This is consistent with Olson's (1965) argument that for organized interest groups, the marginal costs incurred in lobbying are outweighed by the benefits received by special interests. In this narrower view, recycling policies possess distributive characteristics. For this reason, we also expect that other groups oppose recycling expansion due to the selective costs these groups have to bear. Landfill and waste-to-energy plant owners and operators are likely to oppose recycling policies that endanger the expansion of their businesses.

States with more active environmental groups/associations are more likely to adopt pro-active recycling legislation. State membership data on the National Wildlife Federation is used to develop a measure of the number of members per thousand inhabitants of state population that belongs to an environmental interest group.

With several interest groups supporting or opposing alternatives/tools of solid waste management, one can expect that elected officials will respond in a fashion that maximizes their chances of reelection. This argument is equally true when we consider the make up of the community adopting the policy. Accordingly, socio-economic factors such as income, education, and citizen ideology are expected to influence the state legislators choices in a significant way. Next, I review previous work regarding the role of these factors.

Socio-Economic Factors Affecting Supply

As established before, it is important to consider the role of contextual factors in the decisions of elected officials in providing a certain mix of policy instruments in managing solid waste. In this subsection I address state contextual factors such as wealth, education, and political ideology that are expected to influence the decisions of solid waste policy by elected officials.

The impact of wealth upon solid waste management has been reported on several studies (Feiock and West, 1993; Feiock and Stream, 1998). Wealthier communities seem to display larger concern for the environment by demanding more recycling and source reduction programs. The rationale for this positive association seems to be the fact that communities with well-off citizens are more willing and committed to try new programs and are also more concerned with their quality of life. Moreover, from a tax capacity perspective, states will have slack resources to engage in more innovative programs, so that they can express more actively their concern with the environment, even if that brings additional costs in terms of time and money.

Feiock and West (1993) tested competing explanations for the adoption of municipal solid waste recycling programs and concluded that income was positively related with adoption, not only in the economic model, but also in the final model combining all the significant variables of the seven competing explanations. Feiock and West (1992) and Kalan and Feiock (1998) also found income as a significant predictor of recycling program performance.

The importance of the education variable has been highlighted in the literature as a measure of environmental support (Feiock and Stream, 1998). More generally, education is relevant not only because it reflects the communities' commitment towards environmental issues, but also because it translates the populations' understanding of the trade-offs entailed by alternative policy instruments. In other words, educated individuals will be more aware of the importance of the strategies to reduce and reuse and will recognize the environmental costs incurred by not doing so. Mrozek (1996) found that college education was a significant predictor of municipalities' early decisions to adopt a curbside pick up recycling program.

Berger (1997) analyzed data from 43,000 households in Canada and concluded that education and income are both positively associated with recycling usage and access to recycling services. Additionally the author found that living in an apartment was negatively related to both usage and access to recycling services.

Finally, states with more conservative citizens are less likely to support the commitment towards recycling both because they tend to be more reluctant to accept the increased public spending entailed by curbside recycling programs (Wiseman, 1992; Hood, 1995) and because they exhibit less pro-active environmental concerns.

The individual state legislator will favor preventive solid waste policies in communities where the median voter is wealthier, more educated, and more liberal because this will increase his/her chances of reelection.

The income measure is taken from the State Personal Income (1958-96) CD-ROM made available by the Bureau of Economic Analysis of the U.S. Department of Commerce (1997). The data for 1997 is taken from the Statistical Abstract of the United States in its Internet version. The educational attainment variable is measured by the percentage of state population with high school diploma or above. This variable was obtained from the Current Population Surveys of the U.S. Bureau of Census.

Citizen ideology is used as a measure of liberalism to test the hypothesis that a state's tendency to adopt more active recycling policies increases as we move from states with more conservative citizens to states with more liberal population. I take the "updated

1960-1997 citizen ideology series" for the American states constructed by Berry et al. (1998) to test this hypothesis[4].

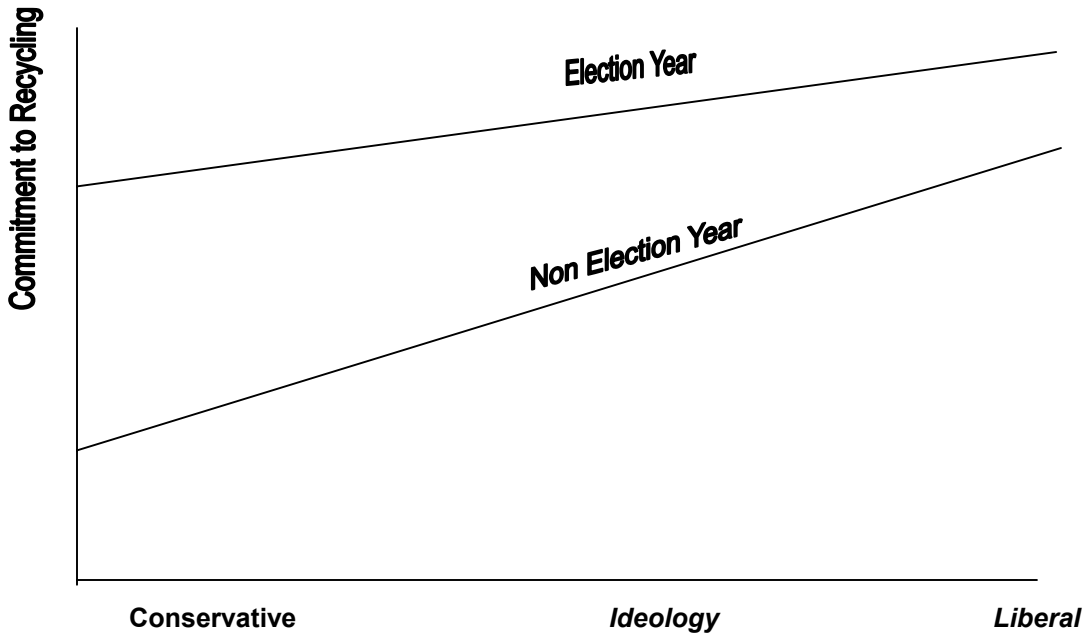
Election Benefits and Ideological Costs

The proximity of elections leads incumbent legislators to press for the adoption of more popular policies that can yield them reelection. Hence, we expect the commitment to recycling and source reduction to increase in election years.

Borrowing the argument from Keohane, Revesz and Stavins (1998) and Feiock and Stream (1998), I contend that the support that elected officials give to recycling legislation is a function of the effort necessary to provide that support, the effect of this activity in the chances of reelection, and the tradeoff between the level of utility derived and the ideological costs of supporting any given alternative. Not all politicians experience this tradeoff to the same degree. Liberals would experience the tradeoff to a lesser degree because the action that is most popular with the public is also congruent with their ideology. For conservatives, however, the adoption of recycling policies to please the public entails the cost of voting against their ideology. This argument suggests an interaction between electoral proximity and ideology, meaning that electoral proximity has a stronger effect on conservatives than on liberals. The hypothesized relationship between the variables, government ideology, election year, and commitment to recycling is depicted in figure 1.

[4] Linear extrapolation is used for the years of 1998 and 1999.

Figure 1



Democrats have predisposition to adopt more pro-active environmental policies than Republicans, because they are more sensitive to environmental concerns. Conservatives are also traditionally more averse to spending than liberals (Khator, 1993). For both reasons, if curbside recycling programs are more costly than other waste management options (Wiseman, 1992), conservatives will favor them less. To test this hypothesis, a measure of government ideology is used. Considering that liberals are more environmentally concerned and more prone to spend, we can also argue that, for conservatives, it is more difficult to support recycling policies because of the "ideological price" they have to pay.

Nevertheless, political parties will tend to favor an option that is politically popular. The election proximity may trigger the adoption of pro-recycling policies even if the government is conservative. For this reason, I hypothesize an interaction between government ideology and election proximity.

State government ideology is measured by the "updated 1960-1996 government ideology series" given by Berry et al. (1998) based on the partisan division of state legislatures, the party of the governor and the ideology of state congressional delegations.

The data for 1997, 1998 and 1999 was obtained through linear extrapolation of the trend 1960-1996.

The election proximity variable is based on the information collected from several editions of the Book of the States published by the Council of State Governments. Electoral proximity is measured by a dichotomous variable, which takes the value of one for an election year (state legislature or governor) and zero otherwise.

In election years, conservative governments are expected to approve more pro-recycling policies than they would otherwise. To capture this, an interaction term between government ideology and election proximity is used. If the coefficient of this variable is positive, our hypothesis is confirmed. However, a negative coefficient is also possible. In that case the impact of elections is stronger among liberals, which confirms that conservatives are not willing to pay the ideological price of supporting policies against the preferences of their constituencies.

A divided government will result in the approval of less pro-active recycling policies because compromises have to be established between the two branches of the state government hindering the frequency and amount of pro-recycling legislation passed. The variable takes the value of one for a state in a given year with a divided government, minus-1 for a unified government, and zero for split control. A divided government is present when the two chambers of the state legislature belong to one party and the governor belongs to the other. Split control means that one chamber of the legislature and the governor belong to the same party, while the other chamber has a majority of the opposite party. A negative coefficient is expected. In addition, a dichotomous variable was created to distinguish between unified Democrat control (=1) and unified Republican control or other combination (=0). A positive coefficient is expected.

Legislative Opportunity Costs

The discussion, vote, and adoption of state solid waste legislation entail opportunity costs for legislatures. As a consequence, I argue that the degree of professionalism of these governing bodies affects the decision to address recycling options.

More professional legislatures will have the resources required to address more policy areas and issues. For this reason, I expect that legislation favoring recycling will increase as the professionalism of the state legislature increases[5]. Legislative opportunity costs are measured by a time invariant indicator of professionalization levels of state legislatures proposed by Squire (1992). The index takes certain U.S. Congress characteristics such as member pay, staff members per legislator, and total days in session and compares these attributes to the ones exhibited by the 50 state legislatures.

In addition to time and agenda constraints, opportunity costs also include financial burdens. As Khator (1993) hypothesized, states with financial difficulties are less likely to devote attention to recycling. The reason for this is simple: states in better fiscal condition have slack resources to pursue more innovative and expensive policies to manage their solid waste stream.

State solid waste expenditures indicate not only the willingness of state legislators to devote resources to this policy, but also their ability to do so. Accordingly states with higher solid waste expenditures per capita are foregoing other uses of the same financial resources and expanding the number of choices within this policy area. Consequently, more state solid waste spending will allow the establishment of higher recycling goals. State solid waste expenditures per capita are collected by the Bureau of Census of the U.S. Department of Commerce.

Uncertainty Costs

When adopting legislation establishing recycling goals, state legislators wish to reduce uncertainty costs, that is, once enacted, they expect that the goals will be pursued by local governments. The way the state legislators minimize uncertainty costs is by adopting higher goals in states where localities are already strongly committed to recycling.

In order to measure local commitment to recycling I employ the proportion of communities in a state with curbside recycling programs. A positive relationship between

[5] In the absence of more appropriate data, legislative professionalism is used as a surrogate measure of the amount of state legislation produced, assuming high correlation between the two variables.

the proportion of local governments with curbside recycling and the recycling goals established by the state legislature is expected.

Commitment Costs

In directing local solid waste policy choices, state legislators will be more successful with local governments in better financial shape. These communities will find it easier to cope with goals and mandates imposed by a higher level of government. State legislators can have an a priori rational expectation that they will be able to impose higher recycling goals in states where local governments spend more on solid waste policy.

Local government expenditures in solid waste are available on-line at the Bureau of Census of the U.S. Department of Commerce. Additional data was retrieved from the 1992 edition of the Census of Governments (1992).

Sunk Costs and Path Dependency

As argued previously state recycling goals are more likely to be obeyed if the local governments are already recycling at high rates. Because state legislators expect to reap benefits from successful pieces of legislation, they will choose higher recycling rates only if they can be achieved. In other words, higher recycling goals will be adopted in states with higher percentages of recycling and where curbside programs are already in existence.

The unavailability of local recycling rates forces us to use the state recycling rate lagged one year as a proxy. In addition, the proportion of communities with curbside recycling programs in the previous year to recycling goal adoption will also be used as an indicator of past practices.

Empirical Analysis

The data used to estimate the empirical model is pooled across the fifty American states and time (1991-1999). The choice of time period is constrained by the lack of

systematic data for solid waste management before the 1990s. Testing different aspects of state solid waste policy is made difficult by the lack of consistency in the available data. Nevertheless, it is possible to identify the recycling goals legislated (or not) by the 50 states throughout the time period chosen.

The model is estimated using ordinary least squares (OLS) with panel corrected standard errors (PCSE). A homogenous first-order autoregressive process is assumed to be common to all panels and to represent the pattern of serial correlation of errors operating within panels. This assumption follows the advice of Beck and Katz (1996) that a common autoregressive parameter, ρ, leads to superior estimates of β even if the data is generated with diverse, unit specific ρ_i. The small number of time periods (9) would not produce consistent estimates of the panel specific ρ_i and hence it was avoided. The data are transformed to produce serially independent errors and the Prais-Winsten transformation is employed. This procedure allows for the use of the first observation in each panel when estimating OLS with PCSE, avoiding the loss of observation due to the differencing procedure (Gujarati, 1995). The OLS parameter estimates resulting from the estimation with PCSE are consistent and the estimation process deals with panel-level heteroscedasticity and serial autocorrelation. Corrections for panel (spatial) autocorrelation were introduced. The election proximity variable was dropped due to extremely high multicollinearity with the interaction term.

(Table II about here)

While Table II summarizes the variables and the expected sign of the coefficients, Table III reports the descriptive statistics for the independent variables. Most of the variables have straightforward interpretation. For example, the average number of landfills in the period considered across the fifty states is 72 with a standard deviation of 102 landfills, ranging from a minimum of 1 (Connecticut 1999) to a maximum of 750 (Texas in 1991). Similar interpretations can be made for other variables directly relevant for the analysis such as the percentage of solid waste recycled, the proportion of

communities in a state with curbside programs, the number of incinerators, or the amount of solid waste produced per capita in tons.

(Table III about here)

Table IV presents the results of the OLS with PCSE estimation using the state recycling goal as the dependent variable[6]. The overall model performs well, accounting for 30 percent of the total variance of the dependent variable (R^2 = 0.30). The Wald chi-square test easily achieves significance at the 99 percent confidence level.

(Table IV about here)

The specific coefficients obtained have a large and interesting number of implications that should be addressed in detail. I proceed by focusing sequentially upon economic tradeoffs between solid waste policy instruments, socio-economic effects, and political transaction costs.

The analysis of the individual coefficients reveals that the landfill variable is significant at the 95 percent confidence level. States with a hundred more landfills have, on average, less 1-percentage point of recycling goal, when the remaining variables are held constant. The incineration variable indicates that no trade-off exists between recycling and incineration, which confirms previous findings (Tavares, 2000). The unit-based pricing programs are positively correlated with recycling goals, but the effect is not statistically significant.

The impact of environmental interest groups appears to be positive and strong. An increase in the NWF group of one member per one thousand state inhabitants increases the state recycling goal by 0.8-percentage points. This confirms the expectation that state legislators are responsive to environmental interest groups.

One of the most remarkable results of the model is the substantial impact of population density in the recycling goals. An increase in a hundred individuals per square mile (the population density measure) in a given state increases, on average, 0.5

[6] The recycling goal is legislated as the percentage of the total solid waste generated.

percentage points the recycling goal adopted by the state. Simply, this means that states with greater population density are more likely to establish higher recycling goals. According to the expectations, solid waste per capita is also positive, *albeit* non significant. If the two measures are thought to portrait economies of scale, we can conclude that the results are fairly consistent with prior expectations.

The socio-economic measures have contradictory effects. The variable measuring personal income is statistically significant at the 95 percent confidence level and in the expected direction. A state where the income per capita is a thousand dollars higher has, on average, 0.6 percentage-points higher recycling goals. However, education seems to have an effect against expectations and previous work (Mrozek, 1996; Berger, 1997; Feiock and Stream, 1998). Not only the effect on recycling goals is negative but statistically significant. A substantive plausible reason for this might be the recognition by more educated citizens of higher administrative costs entailed by recycling activities such as curbside recycling. This, however, remains to be confirmed. The citizen ideology measure is positive but not statistically significant.

Government ideology is statistically significant at the 95 percent confidence level and its coefficient has a positive sign, just like predicted. An increase of 10 points in the index of government ideology (increased liberalism) increases a state's recycling goal by 0.5 percentage points. The coefficient of the interaction term between government ideology and election proximity measures the ideological costs of adopting higher recycling goals in election years. The coefficient is negative and significant at the 95% confidence level indicating that conservatives are not willing to pay the ideological cost of voting against their ideological beliefs. More importantly, the results concerning government ideology and the interaction term are consistent with the idea that conservatives are, in general, less prone to support recycling, independently of factors such as election proximity.

The results regarding political transaction costs also have interesting implications. Although legislative opportunity costs and tradeoffs are not confirmed, the model provides plenty evidence of rational expectations by legislators when adopting recycling legislation. Uncertainty costs are minimized by legislators adopting higher recycling goals in states where local governments are already committed to recycling. The variable curbside recycling lagged one year confirms this expectation. Hence, legislators are able

to claim credit for the adoption of recycling goals independently of how ambitious these goals are.

The past matters. States where local governments are already committed to recycling and where the recycling rates are high are also more likely to have higher recycling goals established by law. An alternative specification of the same model confirmed the opposite effect of landfilling rates: states with higher landfill rates are also less likely to legislate high recycling goals.

One last variable included in the model as a control – bottle bill law – is also statistically significant. In the end of the 1970s and beginning of the 1980s, ten states adopted bottle bill laws. The model shows that states with bottle bill laws are more likely to have higher recycling goals. In fact the goals are likely to be higher, on average, by 9-percentage points. In the last section, we present the conclusions of this research and suggest future studies to be undertaken in this policy area.

Policy Implications

The 1990s were characterized by a trend of diminishing number of landfills for space constraints and environmental reasons. Increasingly, states have relied more in recycling as an alternative policy instrument to deal with the increasing solid waste stream. The empirical analysis allowed us to confirm that recycling has been coupled with incineration and unit-based pricing programs to provide an alternative to landfilling. Furthermore, states characterized by wealthier and more liberal citizens and governments have higher recycling goals, which is consistent with previous findings.

The findings regarding the impact of education indicate that the costs of environmentally friendly alternatives such as administrative costs of curbside programs and opportunity costs of the recycling activity itself might affect negatively the decision to adopt higher recycling goals.

This project also confirms the impact of policy preferences, uncertainty costs and path dependence in the adoption of state legislation favoring recycling. The analysis of the results seems to confirm the obvious, indicating that suppliers are able to control the policy content to their own political advantage. In fact, it is clear that the number of

municipal curbside-recycling programs in existence and the overall recycling rate in a state are important determinants of the state recycling goals.

The results are also consistent, at least in part, with the theoretical framework presented. On one hand, the economic explanation is confirmed by the findings regarding the influence of the number of landfills and population density. The first variable confirms the economic trade-off in terms of alternative policy instruments while the effect of population density confirms the argument regarding economies of scale in recycling.

On the other hand, the empirical findings regarding income, environmental interest groups, citizen liberalism, government ideology and its interaction with elections confirm the idea that socio-political variables also play an important role in explaining state legislators' commitment to recycling goals.

Future research should address other state level options regarding recycling such as recycling mandates and provision of incentives. Data for this research is not available at the moment, but the relevance of the analysis justifies more intensive commitment to this project in the near future.

Table I - Trends in Municipal Solid Waste Generation (1960-1990)

Year	Waste per capita (pounds per day)	Population (in thousands)	Paper	Plastics
1960	2.7	179,979		
1970	3.3	203,984	36.3	2.5
1980	3.7	227,255	36.1	5.2
1990	4.5	249,398	36.7	8.5

Source: http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm

Table II
Variable Measurement and Predicted Coefficients

Variable	Description	Predicted coefficient
Landfilling	Number of landfills (*Biocycle*)	-
Incineration	Number of incinerators (*Biocycle*)	-
Unit Based Pricing	Number of UBP programs (EPA)	+
Density	Population per square mile	+
Solid waste amount	Tons per capita (*Biocycle*)	+
Income	Personal income per capita	+
Education	% of state population with high school or above	+
Citizen ideology	Berry et al. (1998)	+
Environmental interest groups	NWF membership per thousands	+
Government ideology	Berry et al. (1998)	+
Legislative professionalism	Squire (1992) (time invariant)	+
Divided government	Dummy variable (1=Divided 0=Split –1=Unified)	-
Unified government	Dummy variable (1=Democrat 0=Republican)	+
Interaction	Government ideology * Election proximity	+/-
State Solid Waste Expenditures (t-1)	State solid waste expenditures per capita	+
Local Solid Waste Expenditures (t-1)	Local solid waste expenditures per capita	+
Curbside recycling (t-1)	Proportion of communities in a state	+
Recycling Rate (t-1)	State recycling rate (Biocycle)	+
Bottle Bill	Dummy variable (1=State w/ Bottle Bill)	+

Table III
Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Landfilling	451	72.39	102.08	1	750
Incineration	451	2.96	3.738	0	17
Unit Based Pricing	451	63.088	208	0	1843
Density	451	277.31	792.24	.971	5668.9
Solid waste amount	451	1.145	.34	.4249	2.654
Income	450	23424.31	3649.55	15528	37452
Education	451	82.27	67.1	67.1	92.8
Citizen ideology	451	46.32	14.4	4.74	84.037
Environmental interest groups	437	4.39	3.25	0	23.535
Government ideology	451	47.28	27.26	0	98.47
Legislative professionalism	450	.221	.143	.042	.659
Divided government	442	-.127	.85	-1	1
Unified government	442	.244	.43	0	1
Interaction	451	20.93	29.48	0	97.24
State Solid Waste Expenditures (t-1)	450	6.905	12.84	0	75.80
Local Solid Waste Expenditures (t-1)	450	40.342	22.67	1.29	123.47
Curbside recycling (t-1)	450	19.52	24.38	0	97.33
Recycling Rate (t-1)	450	18.97	11.03	1	48
Bottle Bill	451	.202	.40	0	1

Table IV

OLS with Panel Corrected Standard Errors
(Dep. Var.: State Recycling Goal)

Variable	Slope Coefficient	Panel Corrected Standard Errors	t-ratio
Number of Landfills	-.103*	.006	-1.648
Number of Incinerators	.172	.199	0.868
Unit Based Pricing Programs	.003	.004	0.690
Population Density	.005***	.001	4.720
Solid Waste per capita	.687	1.42	0.484
Income	001*	.000	1.680
Education	-.324*	.177	-1.827
Citizen Ideology	.055	.056	0.984
Environmental Interest Gr.	.793***	.201	3.945
Government Ideology	.057*	.032	1.752
Legislative Professionalism	-8.44	8.62	-0.980
Divided Government	-.415	.909	-0.456
Unified Government	-2.05	1.72	-1.194
Interaction Term	-.011[a]	.007	-1.635
State SW Expenditures (t-1)	-.114	.098	-1.163
Local SW Expenditures (t-1)	-.005	.039	-0.118
Curbside Programs (t-1)	.083***	.032	2.610
Recycling Rate (t-1)	.187***	.054	3.455
Bottle Bill	9.22***	3.58	2.578
Constant	28.52**	12.89	2.212
$\rho = .80$	*** P < .01		
R^2 = .30	** P < .025		
Wald Chi^2 = 802.05	* P < .05		
N = 427	[a] P < .06		
	All tests are one-tailed		

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