PUNCTUATED EQUILIBRIUM THEORY: METHODOLOGICAL AND

THEORETICAL EXTENSIONS

A Dissertation

by

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ABSTRACT

The purpose of this dissertation is to add to the understanding of budgetary processes and changes in public organizations. Work in this field has relied upon the theory of incrementalism and punctuated equilibrium theory as explanations of the budgetary process. In short, these theories state that budgetary changes will be mostly small (incremental), but also subject to overly large changes (punctuations).

Categorizations and conceptualizations of incremental and punctuated changes have varied much through the literature. This has led to much confusion over what is and is not incrementalism in budgetary studies. After a review of all the ways in which budgetary changes are characterized and measured throughout scholarly work, this dissertation contributes to the literature by describing four unique types of incrementalism that scholars have utilized in their work. It is the hope that scholars can adopt these terminologies to better communicate how they are conceptualizing incrementalism.

Leading explanations for incremental and punctuated patterns of change revolve around cognitive limitations and institutional friction–the organizational structure of decision-making. To advance the literature, this dissertation draws from public administration literature and theorizes about "non-institutional friction" that influences budgetary changes. Non-institutional frictions are factors aside from institutional structure than can affect budgetary decision-making. Furthermore, this dissertation extends punctuated equilibrium work to examine the consequences of punctuations and incremental changes on public organization performance.

Using data from hundreds of public organizations (Texas school districts) for over a fifteen year period, this dissertation finds support for non-institutional friction. In

addition, results indicate that managers are able to keep relatively stable performance despite rapid (positive and negative) budgetary changes.

DEDICATION

To my family–Mama, Dadoo, Jen, and James.

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1. INTRODUCTION

1.1   Introduction

Public budgeting is at the heart of governments and organizations. The process of obtaining, allocating, and spending money for public goods and services is wrapped with many difficult choices. There are finite financial resources available and many groups fight for a larger portion of funds. Those who can influence government officials and managers for discretionary funds have power in society. In a similar vein, the ability of governments to modify program budgets to meet desired policy levels is another key function of governments and organizations. There must exist a balance between stability and flexibility for organizations to succeed and adapt to changing demands.

There have been decades of research to develop a theory of the budgeting process. One strand of budgetary research examines how allocations change over time and what influences those alterations. The leading theory of the budgetary process is incrementalism. It has been supported broadly throughout budgetary research. Embracing incrementalism while also accounting for large policy changes, punctuated equilibrium theory (PET) has also found a home in budgetary studies. PET has been robustly supported in many contexts [1].

This dissertation expands both theoretical and empirical work in PET. Starting at the foundation, this dissertation reviews the many ways increment and punctuated changes has been conceptualized and measured throughout the literature. A synthesis of the measurement of budgetary changes provides a common language and background for scholars to better communicate incrementalism in their own work.

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[1]A more through literature review of incrementalism and PET is given in later sections.

This literature has moved beyond identifying distributional patterns in budgetary processes to examining those factors that cause more or less punctuations. Leading explanations acknowledge both cognitive limitations and institutional structures that slow down the decision-making process. This dissertation contributes to the literature by showing how features of the organization, besides institutional structures, influence budgetary changes. Particularly, scholarship from public administration is applied to explain other sources of friction in organizations.

This dissertation also contributes to PET by analyzing the consequences of all sizes of budgetary changes on organizational performance. Thus far, the literature has examined what influences punctuations, but not what punctuations do to the ability of organizations to maintain their work. Understanding how the pattern of policy changes identified in PET translates to performance outcomes shows how organizations and governments can maintain work despite large budgetary changes.

Before individual section descriptions, a brief review of PET is necessary.

1.2 Punctuated Equilibrium Theory

Punctuated Equilibrium Theory (PET) incorporates incrementalism, but also accounts for overly large punctuated changes that occur in budgetary changes. The theory predicts that the distribution of policy changes (in the present dissertation, measured through budgets) will have mostly small changes located in the central part of the distribution and many large, punctuated changes in the tails of the distribution. Baumgartner and Jones (2009) borrowed this theory from the physical sciences that describe earthquakes and landslides. In short, this theory states that small changes will build up demand and pressure within a system that will eventually give way as a massive change.

The literature has demonstrated the presence of incremental and punctuated changes in many contexts from local, state, and federal governments, and agencies. It has been robustly demonstrated that this pattern of budgetary changes exists in many different contexts (Jones et. al 2009). The literature is now progressing to identify what factors cause more or less stability in budgetary processes.

1.2.1 Reasons for PET

Literature has identified two major reasons for punctuations–disproportionate information processing and institutional friction. The first reason, disproportionate information processing, is grounded in bounded rationality. Government officials and managers simply cannot analyze all signals and demands in the environment; they can only comprehend a few key issues at one time. This leads to over-reaction to problems when they get the policy attention to under-reacting or ignoring issues when they are out of mind. Taken together, this is what is theorized to lead to the pattern of overly large and incremental changes.

The second theoretical reason for punctuations is institutional friction. In short, this theory states that the process of translating policy inputs to outputs can have repercussions on policy changes. The more veto points or decision clearances, the more friction in the policy system. This friction leads to more punctuations than expected by a normal distribution [2].

These explanations, though, do not account for the time series aspect of predicting punctuations. This is studied by Robinson, Flink, and King (Forthcoming). PET suggests that punctuations occur to relieve pressure within the policy system. Large changes are brought about to correct for neglected problems and bring desired and actual policy levels into equilibrium. This hypothesis–called the Institutional

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[2]Later sections will give more details for this literature review.

Model by Robinson, Flink, and King (Forthcoming)–suggests that the probability of having a punctuation is negatively related to having had one in the recent past. However, another model posited by Robinson, Flink, and King (Forthcoming)–the Error Accumulation Model–suggests that the probability of experiencing a punctuation is positively related to having experienced one in the recent past. Organizational chaos and mismanagement lead to numerous budgetary fluctuations in a short time span. Empirical results support the Error Accumulation Model. Punctuations occur in clusters.

1.2.2   Methods for Testing PET

Empirical methods have centered on univariate tests assessing the normality of the distribution of budgetary changes. The main test was determining the kurtosis value of the distribution. While this can determine the proportion of incremental to punctuated changes and compare it to a normal distribution, the methods could not account for competing explanations of budgetary changes.

In addition to improving the theoretical understandings of why punctuations occur, the literature is also working to advanced the empirical methodology used to test these theories. One important progression has been the use of multivariate hypothesis testing. This has been done by categorizing the distribution of budgetary changes by size–punctuated, incremental, and medium size changes. The categories are then used as the dependent variable in either logit or multinomial logit models, depending on how many distinct groups the variable was split into.

1.2.3   Setting–Texas School Districts

The data used in this dissertation are from Texas School Districts. This data set contains budgetary, performance, personnel, student, management, and organizational information on over a thousand school districts in Texas for an almost 20 year

period. This education data is theoretically a good setting for this dissertation given that these organizations have similar goals, policy and regulatory environments, and funding structures (mostly from state and local sources). While the districts are similar in their broader goals and environment, Texas school districts have a lot of variation in other aspects. District enrollment, organization centralization, standardize test performance, racial diversity, teacher experience, and budgetary choices (to just name a few) all vary within this context.

A major component to this dissertation is that management and decision-makers in the organization are able to control their budgets. In Texas, each district has some level of discretion over their budgeting decision. Typically, budgetary decisions are made by the superintendent and school board of a district. Depending on how large and professionalized the school district is, members of the central administration staff may assist in the budgetary process. Overall, though, the budgetary process in this setting is a top-down structure. These similarities become key in choosing appropriate budgetary, performance, and institutional structure measures that are common across all organizations for empirical analyses.

Empirically, this large data set provides a good testing ground for this dissertation. Budgetary punctuations are rare events. To observe many punctuations, a large data set is needed. This data set provides over 18,500 cases–enough to examine many punctuations.

1.3   Section Overview

The subsections below outline and motivate the empirical sections of this dissertation.

1.3.1 Section Two: Conceptualizations and Measurement of Budgetary Change

Incrementalism is heavily critiqued for its breadth and lack of depth–it has been applied in many ways by scholars in academic research. Conceptually, it has many definitions. It is also criticized because it only accounts for small changes. Incrementalism does not offer a theoretical explanation for medium and large budgetary changes. However, even with these shortcomings, the theory could not be wholly dismissed given that budgets do have mostly small changes over time.

Through the decades of budgetary work, there have been numerous ways in which incrementalism has been characterized and evaluated. To give just a few examples, incrementalism has been used as a descriptive theory and predictive theory. It has also referred to institutional structures, procedures, and budgetary outcomes. This has been further complicated with the advent of Punctuated Equilibrium Theory (PET) that considers not just incremental changes, but large punctuated changes. Conceptualizations then extended to explaining overly large changes and not just small and "not small" changes.

In addition to the numerous conceptualizations of incrementalism and punctuations, there has also been many different ways in which it has been empirically measured–even within each conceptualization. Many of these measures categorize budgetary changes based on their size–incremental and non-incremental. This stems from theory that examines incremental, non-incremental, and punctuated changes. However, this approach has a few drawbacks. One limitation of this categorization is that it masks the variation needed to advance the study of budgetary changes. In addition, this two part categorization combines positive and negative changes. This hinders the theoretical development of understanding what leads to and what is the impact of positive and negative changes. Other categorization schemes have divided

budgetary changes into five categories–negative punctuation, negative medium, incremental, positive medium, and positive punctuation. This preserves more of the variation and separates positive and negative changes.

With all of these unique meanings and measures, it increases the difficulty of scholars to advance the field. As budgetary and PET literatures progress in empirical work, it is essential that scholars review the conceptualizations and measurement of incremental and punctuated changes. Section 2 of this dissertation will synthesize the literature and develop four typologies of incrementalism. Although scholars will never agree on one common conceptualization or measurement scheme, it is necessary to have a common core understanding of the ways in which we characterize incrementalism and punctuations and its consequences for research.

1.3.2   Section Three: Other Sources of Friction to Influence Budgetary Punctuations

To explain budgetary changes, PET has relied on institutional and cognitive factors to explain how friction in the organization leads to punctuations. Of course, this was the original intent of Baumgartner and Jones–to examine how institutional structures shape policy changes. This work has produced robust findings that institutional friction yields leptokurtic distributions. However, there are other components of organizations, aside from its structure, that influence the potential for policy stability. Public administration literature argues that managers, workers, performance, and other environmental factors have direct impacts on stress within the organization.

Section 3 in this dissertation takes two basic variables from public administration literature–organization performance and personnel stability–to examine how they affect budgetary changes in the organization. Drawing from Texas school districts, the dependent variable (budgetary changes) will be measured by the annual percent-

age change in instructional spending per student. This budget represents the core function of the organization–educating students. Typical to public administration studies that use education data, organizational performance will be measure by the district percent student pass rate of the standardized test. Personnel stability will be measured by the percent annual teacher turnover.

By bringing public administration to PET, a better understanding can be gained on how organization features, besides the institutional structure, can influence stability. Even with a stable structure in the organization, an unstable workforce or poor performance (examined in this study) can create stress within the institution that can yield volatile policy outcomes. Failing public organizations are likely to grab the attention of citizens and policy makers. In turn, they are likely to experience large policy changes to try to jolt the organization to improve. Organizations that are succeeding will not have the same pressure to change their work since they are already doing well. For personnel, high turnover can signal dissatisfaction among employees and stress in the organization. This results in large policy changes.

1.3.3 Section Four: Extending PET–Consequences of Budgetary Changes on Performance

The budgetary and PET literatures have considered budgets as outputs. However, they are also inputs that influence how well the organization performs. How financial resources influence organization outputs and outcomes has been examined in both public administration and political science literatures. A lot of this work has examined how budget cuts influence agency performance. It has produced mixed results. While some scholars contend the actual dollar amount impacts work, other scholars find the signal sent to organizations by cutting funds actually decreases work.

In the public administration context, managers are expected to take any size budgetary input and maintain or improve performance. One of their key tasks is creating stable outcomes from unstable inputs. Punctuated equilibrium literature has not yet considered how the leptokurtic distributions translate in the implementation phase to outcomes. Section 4 of this dissertation examines this question–how can managers "order chaos" from budgetary changes to performance stability?

The dependent variable for empirical analyses in this section is the annual percentage change in the standardized test pass rate for a district. The main independent variables are dummy variables for the categories of budgetary changes (with incremental changes as the base category). Other factors that are known to influence performance are included as controls in the model. However, these are factors known to influence the absolute level of performance–not necessarily the change in performance.

1.4 Conclusion

Every government, institution, and organization has to work with budgets. This dissertation adds to the understanding of the conceptualizations, measurement, causes, and consequences of budgetary changes. The goal of this dissertation is to increase the knowledge of the budgetary process by drawing from political science and public administration literatures. It can help inform public agencies when to expect stable and volatile budgetary environments.

Scholars have successfully demonstrated how institutional structures influence the policy making process. This has led to a better understanding of how organizations maintain stability and on the other side, remain in fluctuation. However, institutions may have similar structures but experience different issues that must be addressed within the organization. Each year, managers face unique problems in their organi-

zation. These issues must influence budgetary decisions within the organization. In this dissertation, I aim to explain how non-institutional factors of concern to all public organizations–performance and personnel turnover–impact budgetary changes, as well as, the consequences of those budgetary changes on the organization.

2. THE UNSTABLE USE OF STABILITY–CONCEPTUALIZATIONS AND MEASUREMENTS OF INCREMENTAL AND PUNCTUATED CHANGES

2.1 The Unstable Use of "Stability"

The literature on incrementalism has become a "muddled" mess. Quite ironically, one common definition of incremental is "regular" or "stable" (Dempster and Wildavsky 1979) though its meaning has been anything but regular or stable. Scholars have defined and redefined "incremental" to fit a variety of research needs. It has been used as a normative, descriptive, explanatory, and predictive theory throughout the literature (Berry 1990; Tucker 1982; Wanat 1974). As such, there are numerous working definitions that have caused the study of incrementalism to expand in breadth rather than in depth. To name a few, incrementalism has been defined as a method of problem solving, a process of interaction, a theory of organizational behavior, a theory of policy development, a shift in organizational relationships, and the size of monetary change (Berry 1990; Dempster and Wildavsky 1979). Berry (1990) condenses these to three general definitions of incrementalism: simple decision rules, regularity of relationships, and lack of effect of external variables.

Since incrementalism has come to describe so many diverse actions and outcomes, Berry (1990) believes it has lost a true meaning and recommended that the term be dropped completely from future works. While the term is not likely to leave academic research because it is the foundation of budgetary studies, it is necessary to review and refine its definition and use in scholarly work.

Coupled with its broad definitions, the measurement and operationalization of incrementalism have varied widely in the literature (Berry 1990). Likewise, the measurement of non-incremental changes has varied as well. Categorization was further

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complicated with the advent of Punctuated Equilibrium Theory (Baumgartner and Jones 2010) which emphasized the study of large, dramatic changes known as punctuations. The "punctuations" category described extreme non-incremental changes. Their measurement has also varied. These inconsistencies will be explained in detail in this section.

The incremental and punctuated equilibrium literature is transitioning from simply identifying that these processes exist in a variety of budget contexts to examining the political and administrative factors that contribute to the stability and volatility in the budgetary environment. In conjunction, the empirical methods in the literature are advancing from univariate tests to multivariate hypothesis testing. Univariate tests of incrementalism and punctuated equilibrium theory revolve around checking the normality and kurtosis of the distribution of budgetary changes (Jordan 2003; Baumgartner et al. 2009; Jones, Sulkin, and Larsen 2003; Mortensen 2005; Robinson 2004; John and Margetts 2003; Breunig and Koski 2006; Breunig 2006; Baumgartner, Foucault, and François 2006). When a distribution of budgetary changes has a statistically significant level of kurtosis, punctuated equilibrium theory is said to be supported. These methods, however, merely identify that these phenomena exist instead of exploring the determinants of stability and volatility. Some attempts at characterizing the budgets that experience more or fewer punctuations and incremental changes compare the distributions across policy types (Jordan 2003) or institutional structures (Jones et al. 2009).

While this does lead to some description of reasons for incremental and punctuated changes, it does not control for other competing hypotheses. Robinson et al. (2007) provide the first multivariate hypothesis test of the magnitude of policy change. By categorizing the size of changes, Robinson et al. (2007) are able to use multinomial logit to test for other organizational factors (organization size, growth,

centralization) that can affect the degree of budgetary punctuations. In another article, Robinson, Flink, and King (Forthcoming) split the distribution of changes into two categories: punctuated or not punctuated. Using a logit model, this paper examines the role of organization history in explaining punctuations while controlling for the variables in the Robinson et al. (2007) model.

As the literature moves in this direction, it becomes important for scholars to reflect on how the monetary size and type of changes are categorized as incremental, non-incremental, or punctuations. To expand the understanding of the determinants of budgetary processes, there must be some consistency and clarity in the different ways in which categories of changes can be determined. If scholars continue to refer to their individual operationalizations using the broad umbrella term "incremental," then there is little hope in escaping this muddled mess.

In this section, a framework is developed to synthesize the unique operationalizations of incremental, nonincremental, and punctuated changes with regards to budgets. Apart from works that have reviewed the operationalization of incrementalism by comparing the works of individual scholars, this section uses mathematical models as a more generalizable presentation of unique types of incremental measurement schemes. Four different types of incrementalism are presented and elaborated by how authors have applied each in the budgetary literature. The hope is that scholars can adopt these terms to describe the type of incrementalism they are examining in their own work.

2.2   Single Budgets: Simple Comparisons

The subsection below introduces the model that will be expanded upon in this section.

2.2.1 The Basic Model

The first consideration in determining the magnitude of policy changes must be the budget of interest. For the purposes here, a budget (B) for any one context and year will be denoted as:

$$B = x_{it} \tag{2.1}$$

Where:

x is the dollar amount budgeted,

i is the context, and

t is time.

Each of these variables warrant further discussion.

In this work, x is defined as an actual dollar amount and can be any positive value. However, depending on the researcher's needs, the measurement of x can take different forms. In some cases, hierarchical structures in the budgetary process direct its measurement. For example, x can be the proportion of funds for a single program from the overall budget. Berry (1990) refers to these as "share of the budget" models. These models have been enhanced with other types of measures like "prosperity scores" (Natchez and Bupp 1973; Gist 1982; Danziger 1976). When x is a proportion, it can only take values from 0 to 100. This type of measurement of x is possible when studying programs or agencies that are funded from larger budgets like governments and organizations. Budgetary studies that encompass entire governments or organizations, for example the United States Total Budgetary Appropriations, cannot be a proportion of funds since the entire budget is being analyzed.

The subscript i denotes the context of the budget. Context refers to two components: the institution or program and budgetary stage. There have been many different institutional contexts to budgetary studies: government agencies, local, state,

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federal governments from multiple countries, and organizations. Specific programs within each of these entities have been analyzed, as well. Each of these institutions and programs has displayed elements of incrementalism punctuated equilibrium theory.

In addition, i can also represent different parts or stages of the budget–expenditures, requests, or appropriations. Each of these types of budgets is utilized individually or in combination in budgetary research. In analyzing just one type of budget, scholars can determine how they fluctuate through time and what influences those changes. Comparatively, scholars can study the differences between each of the budgets at any point in time as well as analyze the dynamic relationship and bargaining processes between those involved in the budgetary process. For example, in the United States budgetary context, the relationship between agencies, Congress, and the president can be analyzed by looking at each of their proposals and the final appropriated amount. If comparisons need to be made to i across institutions, policy types, or budgetary stages, they will be denoted by j or k.

The time variable, t, is predominantly measured annually. The annual date marker depends on whether the fiscal, calendar, or electoral year is the focus of the study. The value of t is any positive integer number.

2.2.2   One: Relative Budget Incrementalism

The first of the four types of incrementalism is *Relative Budget Incrementalism* (RBI). This idea is founded in Dye (1992) definition of incrementalism as the stability in the distribution of funds by existing functional categories. This type of incrementalism compares different institutions, programs, or policy types (i) relative to one another in the same time period t. In other words, it is concerned with the relative ranking of budget categories (from least to greatest amount). For example,

if the top most funded program continues to be the most funded program in the future, the process could be incremental. If in a specific time period another program becomes the most funded, surpassing the other program, this process is deemed non-incremental. Hence, to judge incrementalism, one needs a spectrum of budgetary programs to compare and contrast dollar amounts. In mathematical notation, this must always hold true for any value of t for a process to be incremental:

$$RBI = x_{it} < x_{jt} < x_{kt} \tag{2.2}$$

Where i, j, k are unique budget categories.

In this concept of measurement, non-incremental changes occur when a program surpasses the funds of another program it once lagged. Using the notation, a non-incremental process can be defined as:

$$x_{i(t-1)} < x_{k(t-1)} < x_{j(t-1)} \tag{2.3}$$

$$x_{it} < x_{jt} < x_{kt} \tag{2.4}$$

As you can see, k's budget became greater than j's budget from $t-1$ to t.

To better illustrate this type of incrementalism, numerical examples are below for hypothetical programs i and j. We see that:

$$x_{i(t-2)} = 3.500, \; x_{i(t-1)} = 5.250, \; x_{it} = 7.875$$
$$x_{j(t-2)} = 4.000, \; x_{j(t-1)} = 5.000 \; , \; x_{jt} = 4.700$$

Comparing these two programs by year:

$$x_{i(t-2)} < x_{j(t-2)} = 3.500 < 4.000$$
$$x_{i(t-1)} > x_{j(t-1)} = 5.250 > 5.000$$

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$$x_{i(t)} > x_{j(t)} = 7.875 > 4.700$$

The move from $t - 2$ to $t - 1$ is relative budget non-incrementalism since i's budget grows larger than j's budget. The move from $t - 1$ to t is relative budget incrementalism since i stays larger than j.

2.2.3 Two: Procedural Incrementalism

Others have recognized incrementalism as the regularity of structural relationships in budgetary procedure among actors whom determine budgets (Dempster and Wildavsky 1979). This is *Procedural Incrementalism*. Overall, it is concerned with consistency in the manner by which budgets are decided. A punctuation, non-incremental change, or "deviant" case (Davis, Dempster, and Wildavsky 1966) occurs when the relationship among budgetary actors, decision rules among participants, or other factors in the environment are adjusted. Deviant cases–or procedural non-incrementalism–can be placed into four broader groups: political, administrative, economic, and social (Davis, Dempster, and Wildavsky 1974). Examples include: significant policy change, fiscal policy change, additional Congressional supervision, amended estimate due to time factor, single event, large new legislative program, change in the partisanship of government leaders, or reorganization of an agency (Davis, Dempster, and Wildavsky 1966). This is the only type of incrementalism that cannot be determined by solely examining the budget numbers–researchers must become aware of the environment of the budgeting process.

Following the same mathematical notation, a change is procedural incremental if the temporal sequence of elements is such:

$$x_{i(t-1)}, x_{it} \tag{2.5}$$

A change is procedural non-incremental if the temporal sequence of elements is such:

$$x_{i(t-1)}, x_{i't} \qquad (2.6)$$

Where i' denotes a change in the structural relationship of budgetary actors.

2.3 Multiple Budgets: Budget Growth and Decline

One shortcoming of evaluating the dollar amount allocated to every program is its limited use in comparing budgets. As Natchez and Bupp (1973) explain, "programs vary widely in their scope, size, and content, and these differences are unfortunately reflected in their budgets." The actual dollar amount or the proportion of funds can be misleading in judging a budget's priority or value to society. To cope with this, scholars needed a way to "normalize" the empirical study of budgets. As a result, incrementalism was re-conceptualized by analyzing the growth and decline of a budget over time. Emphasis was placed on how closely the budget of the previous year matched the current year.

At the most basic form of growth and decline, incrementalism would be measured as the difference between this year's and last year's budget amount. Using the framework, the operationalization would be:

$$x_{it} - x_{i(t-1)} \qquad (2.7)$$

Another setting for the simple subtraction is the difference between the dollar amount at various budget stages in the same time period. One common application of this involves the difference between agency requests and congressional appropriations

(Fenno and Jr. 1966; Sharkansky 1968). This would look like:

$$x_{it} - x_{jt} \qquad (2.8)$$

Where i and j are unique budgetary stages.

Beyond the annual difference in funds, other studies examine the percentage difference between two consecutive annual budgets (Robinson, Flink, and King Forthcoming; Robinson et al. 2007; White 1994; Breunig 2006; Breunig and Koski 2006; Jones, Sulkin, and Larsen 2003; Jones, Baumgartner, and True 1998; Fenno and Jr. 1966). Annual percentage changes allow a systematic comparison of the magnitude of change between organizations and years that cannot be offered from simple subtraction.

The formula for percentage change is:

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \qquad (2.9)$$

At the introduction of this method of measuring incrementalism, scholars disagreed about whether to include negative values or only report the absolute value of percentage change. Literature that did not distinguish between positive and negative modifications to the budget used the formula:

$$\left| \frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \right| \qquad (2.10)$$

2.3.1   Three: Mathematical Incrementalism

In a popular definition, a budget is incremental and stable if its annual percentage change is within some predefined boundary. Non-incremental changes are those

observations outside of the boundary. This operationalization of incrementalism is called *Mathematical Incrementalism* because the determinant of incremental versus non-incremental is a number predefined as a cut point. Furthermore, each annual change is an independent event in the measurement–various annual changes do not influence one another in their categorization of incremental and non-incremental. The uniqueness of Mathematical Incrementalism will become clearer once the final type of incrementalism is discussed in the next subsection.

In addition to disagreements on whether a negative change could be considered as incremental, scholars debated the percentage size that could be categorized as incremental. In turn, the threshold between incremental and non-incremental categories has varied in the literature. Among the works that exclusively examine positive changes, incremental observations were between zero and ten percent (Wildavsky 1964; Bailey and O'Connor 1975; Fenno and Jr. 1966) or as an extension, zero to 20 percent (Fenno and Jr. 1966).

Using the same framework, incremental observations with absolute value percentages meet the requirement that:

$$\left| \frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \right| \leq C \tag{2.11}$$

Where:

C is a predefined cut point between incremental and non-incremental values.

It follows that non-incremental observations will meet the criteria that:

$$\left| \frac{x_{i(t)} - x_{i(t-1)}}{x_{i(t-1)}} \right| \geq C \tag{2.12}$$

There are, however, drawbacks with grouping together positive and negative values. One shortcoming is that it masks much of the variation and, in turn, limits theoretical developments on predicting increases and decreases in budgets for non-incremental and incremental values. On the practical side of budgeting, the implications of a gradually decreasing budget are different than a gradually increasing budget. All of these small changes can be lumped into the sole incremental category, but have drastically different implications for the organization over time.

As another consequence, studies that examine the causes or characteristics of stable and volatile budgets were not able to consider the direction of the change (positive or negative). The catalysts, though, for positive and negative changes are unique. Even today this theoretical question has not been fully examined and many questions still remain on the topic. My preliminary analyses (discussed in later sections of this dissertation) suggest that the causes for decreases are different than the causes for increases in budgets.

Another drawback of the absolute value measure is that the proportion of positive to negative changes could not be assessed. Upon splitting the changes by their parity, it was observed that the probability of experiencing each type of punctuation was different–there tended to be more positive than negative changes (Jones et al. 2009). The magnitude of the positive and negative values were also dissimilar: positive values are more positive than negative values are negative. The absolute value of changes does not allow for these distinctions. Once scholars began to pay attention to the parity of the percentage change, the cut point measurement system was tweaked. The demarcation was no longer symmetric for positive and negative changes–the positive boundary was more positive and the lower boundary was less negative to create two unique negative and positive cut points. For example, Jones,

Baumgartner, and True (1998) and True (2000) both used negative and positive incremental cut points of -15 and 20 percent, respectively.

Robinson et al. (2007) and Robinson, Flink, and King (Forthcoming) take a different approach to determine the cut points by overlaying a normal distribution on the leptokurtic distribution of annual budget changes. These two distributions have four intersections, two above and two below the mean. Incremental changes are those observations between the interior intersections–10 and -2 percent.

The new general form of analysis for incremental changes became:

$$C_a \leq \frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \leq C_b \tag{2.13}$$

And for non-incremental changes:

$$C_a \geq \frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \tag{2.14}$$

Or,

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \geq C_b \tag{2.15}$$

Where:

C_a is the lower bound cut point, and

C_b is the upper bound cut point.

Variables C_a are C_b are, again, usually percentage values. C_a is usually a negative value and C_b is a positive value. However, as explained above, these two variables usually do not hold the same absolute value. The absolute value of C_a tends to be smaller than C_b .

The above measurement scheme is for a dichotomous categorization of incremental versus non-incremental changes. With the advent of Punctuated Equilibrium

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Theory, a modified categorization system was introduced that split the distribution of changes into five distinct groups with an additional two "punctuation" categories. The additional two categories applied more stringent criteria for punctuations by using extreme positive and extreme negative cut points.

Similar to the measurement of small changes, the size requirement of a punctuation has varied and been somewhat arbitrary in the literature. In some articles, a punctuated change is 30 percent or larger (Wildavsky 1964; Bailey and O'Connor 1975; Baumgartner and Jones 2010). Jordan (2003) identifies positive punctuations as greater than 35 percent and negative punctuations as less than -25 percent. Robinson et al. (2007) and Robinson, Flink, and King (Forthcoming) define the punctuations as below -33 percent and above 35.5 percent using their method of distribution intersections. These are the outer intersection values between the normal and leptokurtic distributions.

In the mathematical framework, a punctuation exists if:

$$C_A \geq \frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \tag{2.16}$$

Or,

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \geq C_B \tag{2.17}$$

Where:

C_A is a more lower bound cut point than C_a, and

C_B is an more upper bound cut point than C_b.

These methodological discussions are especially important with the shift towards quantitative studies in this field and in the discipline as a whole. Some consensus is needed on a percentage size that constitutes a "small" or "large" change so scholars

can build upon each other's work to progress the understanding of budgeting in governments and organizations.

2.3.2 Four: Political Incrementalism

The final type of incrementalism is *Political Incrementalism.* In short, it is the regularity in the annual change in appropriation. Berry (1990) refers to this as an "internalized change model." It is internal since it relies on budget alterations of the previous year to accurately predict the change in the budget for the next year. Incrementalism then occurs when a program experiences similar size changes over time. Unlike Mathematical Incrementalism (which is concerned about each independent year being within some specified boundary) this operationalization of incrementalism relies on annual change *comparisons.* The annual changes should be close to identical, not just within some cut point range. This is what creates a political component to the measurement of incrementalism–the organization obtaining the expected or same resource growth/decline as the year before. For example, if a program receives a 6 percent increase from one year to the next, it probably expects or aims to achieve a similar size growth in the next term. Political Incrementalism values the time series components of budget growth and decline.

In analyzing growth, political incrementalism suggests:

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \approx \frac{x_{i(t-1)} - x_{i(t-2)}}{x_{i(t-2)}} \tag{2.18}$$

It follows that the difference between the annual changes should be close to zero:

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} - \frac{x_{i(t-1)} - x_{i(t-2)}}{x_{i(t-2)}} \approx 0 \tag{2.19}$$

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On the other hand, non-incremental changes are not similar in value from year to year:

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} \neq \frac{x_{i(t-1)} - x_{i(t-2)}}{x_{i(t-2)}} \tag{2.20}$$

For non-incrementalism, it follows that the difference between the annual changes will not be close to zero:

$$\frac{x_{it} - x_{i(t-1)}}{x_{i(t-1)}} - \frac{x_{i(t-1)} - x_{i(t-2)}}{x_{i(t-2)}} \neq 0 \tag{2.21}$$

Other empirical methods fit the political incrementalism idea. In a regression framework, one tool is regressing one year's budget on the next year's budget and analyzing the residuals. Davis, Dempster, and Wildavsky (1966) employ this method and examine residuals of their regression models to determine incrementalism. Incremental changes are those observations with small residuals. The non-incremental changes are observations with large residuals that are not explained by their equations. Bunce and Echols (1978) and Fenno and Jr. (1966) use a regression framework to check for the linearity of budget changes over time. To determine fiscal shocks, Rattsø (2004) uses regression, as well.

To help facilitate the difference between mathematical and political incrementalism, the budgets of programs i and j are revisited. This time, however, the budgets are analyzed for their compliance with mathematical and political incrementalism. The three year budgets for i and j are:

$x_{i(t-2)} = 3.500, x_{i(t-1)} = 5.250, x_{it} = 7.875$

$x_{j(t-2)} = 4.000, x_{j(t-1)} = 5.000 , x_{jt} = 4.700$

First, let's calculate the annual percentage change for each program.

For program i year $t - 1$ and $t - 2$:

$$\frac{5.250 - 3.500}{3.500} = 0.50 \qquad (2.22)$$

For program i year t and $t - 1$:

$$\frac{7.875 - 5.250}{5.250} = 0.50 \qquad (2.23)$$

For program j year $t - 1$ and $t - 2$:

$$\frac{5.000 - 4.000}{4.000} = 0.25 \qquad (2.24)$$

For program j year t and $t - 1$:

$$\frac{4.700 - 5.000}{5.000} = -0.06 \qquad (2.25)$$

Now, substitute these values into the model for mathematical incrementalism. Cut points will be defined as:

$C_a = -0.15$

$C_b = 0.30$

For program i, both changes (both equal to 0.50) are outside of the incremental cut point bounds. This means program i experienced non-incremental changes–it did not meet the requirements for mathematical incrementalism. Program j, on the other hand, had changes between the cut points (0.25 and -0.06) and does meet the requirements for mathematical incrementalism.

Now consider political incrementalism. Program i experienced the same size change each year, therefore, it did meet the requirements for political incrementalism.

The growth over the time span was constant. Program j had a .31 difference in the annual changes (0.25 - (-0.06)). This value exceeds the boundary for political incrementalism–it is politically non-incremental.

This example illustrates that a budget series can meet the requirements for some types of incremental operationalizations, but not others. Program i met the requirements for political incrementalism, but not mathematical incrementalism. Program j under went mathematical incrementalism, but not political incrementalism. As is evident, the way in which scholars define incrementalism can lead to divergent results. Researchers need to be cognizant of the consequences of the type of incrementalism they choose to measure and report in their work. Otherwise, the term "incremental" will continue to be a muddled mess.

2.4 Conclusion

In this work, four types of incrementalism are presented: Relative, Procedural, Mathematical, and Political. Relative incrementalism is about the stability in the ranking of the funds spent on programs. Procedural incrementalism examines the environment in which budgetary decisions are made. Mathematical incrementalism measures whether the annual percentage change of a budget remains within a pre-defined boundary. Political incrementalism evaluates the consistency of growth or decline of program budgets.

To help clear much of the confusion that surrounds the term "incrementalism," these terms are intended to be used as descriptors of the type of incrementalism scholars measure in their work. Since there will never be just one way to measure incremental or punctuated changes, scholars must be clear with the type of incrementalism they are evaluating. However, there are more complexities to the budgeting

process that are not considered in these four types of incrementalism measurement schemes.

For example, not assessed are the hierarchical issues in the budgetary process–how program budgets fluctuate compared to the overall budget changes. To explain, if the overall budget has a two percent budget decrease, do all the programs that stem from the larger budget have two percent decreases as well? Do some programs take larger cuts to protect the funding levels of other programs? This aspect has not yet been implemented into the measurement of incremental and non-incremental changes. In this, would programs that follow the overall budget trend be incremental, no matter the size of change? Would programs with non-incremental changes be those that do not follow the overall budget trend, even if the program budget is stable and the overall budget is not stable?

There are many factors that influence how researchers measure and categorize sizes of changes. This work represents one way to synthesize the concepts surrounding the operationalization of incremental, non-incremental, and punctuated changes.

3. THE PUBLIC ADMINISTRATION OF BUDGETARY CHANGES

3.1   Introduction

The factors influencing the stability of budgetary resources have been studied by many scholars. Typically, these studies occur through the lense of punctuated equilibrium theory (PET). In broad terms, scholars have identified disproportionate information processing, institutional friction, and organizational history as reasons for why policy systems experience punctuated changes.

What has not been considered is the role of organizational features outside of the policy process on influencing budgetary stability and volatility. While the level of decision clearance, centralization, or veto players have proved remarkably robust in affecting the distribution of policy changes, little is known how the characteristics of organizations that give substance to the policy-makers' discussions or the needs of the organization influence budgetary changes. These factors can jolt an organization into making rapid alterations. This study examines two features–organizational performance and personnel stability–to assess how factors outside of the policy process itself can cause friction in a system.

3.2   Literature

The subsections below discuss the literature on incrementalism and PET.

3.2.1   Models of Policy Change

Incrementalism is part of the foundation of policy change studies. This is especially true in the field of public budgeting. The field has dedicated decades to explaining how incrementalism applies–or does not apply–to public budgeting (Wildavsky 1964; Davis, Dempster, and Wildavsky 1966; Wanat 1974). In analysis of

budgets from every level of government, country, agency, or organization, the same general incremental pattern is present: there are mostly small changes from year to year, supporting incrementalism (Cornia and Usher 1981; Davis, Dempster, and Wildavsky 1974). Incrementalism though, is not readily accepted by all budgeting scholars. For one, the term "incrementalism" has become conceptually diffuse. Scholars have used the term to describe a method of problem solving, a process of interaction, a theory of organizational behavior, a theory of policy development, a shift in organizational relationships, and the size of monetary change (Berry 1990; Dempster and Wildavsky 1979). With this many meanings, some scholars have questioned if incrementalism is still a useful term for scholarly works (Berry 1990). However, despite critiques noting the theoretical and empirical shortcomings of incrementalism (i.e. Berry (1990); Dempster and Wildavsky (1979); Tucker (1982); Bailey and O'Connor (1975); Natchez and Bupp (1973)), the theory could not be wholly rejected or replaced with all new theories. Hence, it still remains relevant to budgetary studies today.

Punctuated Equilibrium Theory (PET), borrowed from geological studies, emerged as another theory of the policy process that embraced incrementalism and incorporated the expectation for large changes–a missing element of the incremental theory (Baumgartner and Jones 2010). In this theory, Baumgartner and Jones (2010) relate the policy process to phenomena from the physical sciences like earthquakes and landslides. To explain, earthquakes occur as a result of slowly building pressure from underneath the earth's surface that causes violent shifts of the earth's tectonic plates. The dramatic shift of the earth's plates causes earthquakes. The process of landslides follows a similar pattern. The over time build up of soil, rocks, and sand will yield small changes in the terrain. Eventually though, landslides occur and massively change the area.

Keeping with the bigger picture, these are slow moving processes that eventually lead to dramatic events. Policy processes work in much the same way. Policies typically experience modest changes. Over time though, pressure builds within the policy system from inadequate policy changes. Features of the policy process hinder policy changes from creating an efficient market where policy levels equal policy demands. When slow moving policy processes accumulate enough pressure within the policy system, a large and dramatic policy change results. In punctuated equilibrium theory, these large changes are known as punctuations.

This theory has been supported in many contexts from incarceration rates (Schneider 2006) to election results (Baumgartner et al. 2009), legislative actions (i.e. bill introductions and hearings; (Baumgartner et al. 2009)), environmental policy (Repetto 2006; Busenberg 2004; Wood 2006; Salka 2004), and education (McLendon 2003). The dominant testing ground, though, has been in the field of public budgeting. Local, state, comparative, and United States federal government, agencies, and public organizations have all exhibited characteristics consistent with PET (Jones, Baumgartner, and True 1998; Robinson 2004; Baumgartner, Foucault, and François 2006; Breunig and Koski 2006; Jordan 2003; Mortensen 2005; Breunig 2006; John and Margetts 2003; Jones et al. 2009; Baumgartner et al. 2009; Robinson et al. 2007).

Determining a series' conformity with punctuated equilibrium theory has relied on assessing the shape of the distribution of annual percentage policy changes (annual percentage budgetary changes, in the case of budgetary studies). The distribution is analyzed for how closely it follows a normal distribution. Specifically, the degree of kurtosis (a measure of central "peakedness") is examined. Distributions that support punctuated equilibrium theory have high values of kurtosis (well above three, the kurtosis value of a normal distribution). Distributions with high levels of kurtosis are known as leptokurtic distributions–distributions with significantly more central

observations around the mean and in the tails of the distribution than a normal distribution. Theoretically, this is what punctuated equilibrium theory predicts of the policy change process: mostly incremental changes with numerous sizable changes. This leptokurtic distribution, also known as a power function, is central to punctuated equilibrium studies. It has proven extremely robust and is now advocated as a general empirical law (Jones et al. 2009).

The punctuated equilibrium literature is currently increasing in empirical complexity. Scholars are expanding their work beyond univariate analyses of distributions to multivariate hypothesis testing that can account for other explanations of policy changes. The few published works that use multivariate empirical tests predicting budgetary outcomes have divided the distribution of budgetary changes into categories based on their size to use either logit (Robinson, Flink, and King Forthcoming) or multinomial logit (Robinson et al. 2007). This is an important direction for the literature as it advances understanding of how various features of governments and organizations influence budgetary changes.

3.2.2 Reasons for PET

The literature on PET identifies two broad reasons for punctuations in policy changes: disproportionate information processing and institutional friction.

Disproportionate information processing is an artifact of the direction of policy attention. As the name suggests, this explanation of punctuated equilibrium theory attributes policy changes to the tendency of policy-makers and policy-making institutions to react disproportionately to new information (Jones 2001). This is in contrast to proportionate information processing (Jones and Baumgartner 2005) in which policy makers form policy decisions proportional to information within the environment. Officials, though, cannot adequately process all information since there is only a lim-

ited amount of policy attention they can give (Jones and Baumgartner 2005). As a result, policy systems commonly go through periods of under-responding or ignoring information to overreacting to it (Jones and Baumgartner 2005; Workman, Jones, and Jochim 2009). The over and under reactions contribute to the leptokurtic shape of the distribution of policy changes found broadly in policy systems.

Institutional friction, the other explanation for policy punctuations, occurs as a result of the institutional barriers or decision clearance points in the policy-making process. Friction is a term used to account for the difficulty in the process of making policy changes. The more hurdles there are in the process, the more friction there is within the policy system. This has consequences for policy alterations. While institutional designs with multiple actors and decision-clearances promote checks and balances (which provide comfort to citizens), they slow down the policy process. This in turn, builds pressure within the policy system. Over time, the accumulation of pressure from inadequate policy modifications, will yield a punctuation.

There have been many different ways in which friction has been measured. The measure is meant to describe the concentration of power or the barriers in deciding policy changes. Institutional friction has been measured by bureaucratization (broken down to centralization and organization size), stage in the policy cycle, political system (presidential or parliamentary), executive dominance, single-party governments, bicameralism, partisan control of government, partisan distance of governing parties, and decentralization (Robinson et al. 2007; Robinson 2004; Jones et al. 2009; Baumgartner et al. 2009; Breunig 2006). Empirically, each of these factors affects the degree of kurtosis in the distribution of policy changes.

These reasons for punctuations–disproportionate information processing and institutional friction–suggest unique expectations about how the history punctuations influence the probability for future punctuations. Robinson, Flink, and King (Forth-

coming) develop two theoretical models of the effect of organizational history on punctuations. In the Error Accumulation model, the probability of an organization experiencing a punctuation is negatively related to having one in the recent past. In this model, punctuations occur to correct the policy system to the desired level of policy. Once this correction has been made, policies will only see incremental changes until the distance between the actual and desired level of policy reach a certain threshold. This approach is consistent with ideas from disproportionate information processing.

The other model of policy change is the "Institutional Model" of policy change that states large policy changes occur from characteristics within the organization (like poor institutional design or mismanagement) [1]. Since the propensity of punctuations is tied to the organizational design, the probability of having a punctuated change is positively related to having one in the recent past. Institutional friction arguments support this model of punctuated policy change. This is the finding by Robinson, Flink, and King (Forthcoming)–punctuations occur in clusters. In other words, a history of punctuations yields a higher probability that organizations will have a punctuation in the future.

3.3 Theory–Untested Sources of Friction: Institutional and Non-Institutional Friction

Literature has demonstrated that institutional friction influences budgetary changes. There are, however, common characteristics of the measures of institutional friction that leave open many questions about other sources of friction within policy systems.

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[1]Some may view the terms "poor institutional design or mismanagement" as strong language since the cited study does not consider organizational performance–it did not test if the punctuated budget changes actually affected performance. The expectation, though, is that large and rapid budgetary changes will negatively influence performance. To give some support, Andersen and Mortensen (2010) find results in line with their growth hypothesis that sustained small, positive budgetary changes positively impact performance.

For one, measures have been endogenous to–conceptualized within–the policy *process*. Indeed, this was one of the original goals of this research agenda–examining the policy consequences of structures of policy systems. Prior to punctuated equilibrium theory, little was known about how the structure of the policy process shaped policy outcomes. Early explanations centered on factors exogenous to–outside of–the process decision-makers must follow to set policy. For example, the political, economic, social, and administrative environments were said to influence policy changes (Davis, Dempster, and Wildavsky 1974).

Punctuated equilibrium literature, however, has progressed in explaining the endogenous factors, while it has left the exogenous factors virtually unexplored. While PET is a theory of government information processing (Workman, Jones, and Jochim 2009), there are other elements to organizations outside of the policy process itself that can cause friction among decision-makers and in turn, affect policy changes. This is especially true in the budgeting process. Budgets are not just artifacts of policy structure–they are pointed decisions made in light of the current demands or environment of the institution or organization. Public organizations are *human* systems that must respond to needs.

The exogenous features of the policy process give substance to the interactions of those within organizations. In this study, these factors are referred to as Non-Institutional Friction. These contextual elements can show stress within organizations and signal a greater need for policy change. By studying attributes of organizations that cause tension among decision-makers (not just the institutional arrangements that affect how outputs are agreed upon) a deeper understanding of friction and the sources of punctuations can be achieved.

A second common feature of the institutional friction policy process measures is their relative stability over time. The fixed measures allow for comparisons of

the institutional arrangements over time–an essential component to understanding the policy change process. However, many aspects of organizations are not stable over time. There are many theoretically interesting questions related to how policy stability persists in light of factors that change frequently within the organization. Instability and uncertainty within organizations create another type of friction that can jolt an organization.

This study addresses both of these points by examining two organizational characteristics that are outside of the institutional decision-making structure and fluctuate over time: organizational performance and personnel instability. These are two important and salient elements to virtually all organizations (Rainey 2003). They are constantly monitored and taken into account for many organization decisions. If either of these features is less than adequate, it can cause issues within the organization. Most likely, there will be disagreement within the organization on the best way to improve the quality of outputs and employee retention. How each element can be a potential source of friction is outlined below.

3.3.1   Organizational Performance

The performance of public organizations is scrutinized by citizens and public officials. Even though they are generally characterized as under-performing (Moynihan 2008; Rainey 2003), the reason for the existence of public organizations is to provide quality goods and services to their clientle. Efforts to increase the efficiency and effectiveness of public organizations have gained momentum. Elected officials have developed extensive accountability systems to incentivize good and penalize bad performance in public organizations. A weakness of these policies is their one-size-fits-all approach. Numerous studies have demonstrated the unequal results of these

programs across organizations (Rutherford Forthcoming; Moynihan 2008; Rainey 2003; Radin 2006). Public organizations have unique missions, environments, and multiple dimensions on which to measure performance–suggesting there is no one way in which they can be motivated or evaluated.

Numerous performance initiatives by government have made attaining set standards a high stakes endeavor. Performance is virtually the biggest concern for any organization. Throughout academic work, this is reflected in management and organization theory's central focus on explaining different aspects of organization performance and effectiveness (Rainey 2003). The literature assessing the determinants organizational performance is large and spans many diverse fields. In practice, outputs are regularly monitored by public officials, managers, employees, and service recipients. Based on what is observed, current and future target levels of performance shape organization work and direction. Over and under-performing organizations, however, must take different approaches to their work. The general assumption is organizations achieve success through proper management of their internal and external environment. When public organizations fall below a set standard, governments must intervene to help manage the situation.

Organizations with sustained high performance have implemented successful policies and properly managed their environment. Assuming no government interventions or other environmental shocks, changes to the organization are typically modifications to existing routines. These organizations are more likely to benefit from increased resources and support from government or the addition of new clients. Organizational goals then focus on maintaining current standards and possible expansion of their work.

There are harsh consequences for under-performing public organizations. With the push for greater accountability, these organizations are threatened by sanctions,

penalties, government interventions, and closure. Managers, employees, and clients want to improve performance, but finding consensus on the best way to achieve that end is difficult. The choice on what alterations to make within the organization is complicated by the many options available to decision-makers. Resources, regulation, markets, organization, and management all influence public service performance (Boyne 2003). Isolating the parts of the organization that need to be changed can cause conflict and friction. In light of this friction, policy changes are likely to be large in desperate attempts for performance improvement. Incremental changes are not likely to provide the jolt needed within the organization to spark performance increases. This leads to the performance hypotheses:

H1: Low performance decreases the expected proportion of incremental budgetary changes.

H2: Low performance increases the expected proportion of medium size budgetary changes.

H3: Low performance increases the expected proportion of punctuated budgetary changes.

3.3.2   Personnel Instability

One of the core concerns of management is their organization's workforce. Human capital is one of the most valuable assets of any organization (Rainey 2003; O'Toole, Meier et al. 2009). Bringing in new talent, retaining workers, and enhancing the skills of employees is essential for the organization to have quality performance. Given the importance of human capital for organization success, personnel instability (employee turnover) is a relatively understudied area of public administration (Selden

and Moynihan 2000; Meier and Hicklin 2008; Raffel 2007). Most works on turnover analyze its effect on organizational performance. The leading theory is that personnel instability leads to lower organization performance (O'Toole Jr and Meier 2003; Meier and Hicklin 2008). However, a refined version of the theory acknowledges benefits from turnover (like the organization staying fresh, bringing in new ideas, and the dismissal of ineffective workers) that suggest its nonlinear relationship with performance (Abelson and Baysinger 1984; Mosher and Kingsley 1936; Meier and Hicklin 2008).

There remain many research questions on the consequences of employee turnover beyond performance. This study examines its effect on policy stability. As stated before, PET focuses on procedures as sources of friction. However, even if structures and procedures can stay constant, personnel turnover induces another type of instability for the organization that changes the dynamics among actors (Weber 1946). High turnover can signal problems and dissatisfaction among employees (Rainey 2003). Additional stress occurs by replacing and retraining workers–it can be a costly endeavor that takes a substantial amount of resources within the organization (Griffeth and Hom 2001; Wright and Kim 2004). In organizations with high turnover, there should be more friction overall, yielding more punctuated changes. Policy-makers may feel the need to enact major policy changes to retain employees. In organizations with low turnover, the friction models suggest there is less tension within the organization leading to fewer punctuations. This leads to the personnel instability hypotheses:

H4: High personnel instability decreases the expected proportion of incremental budgetary changes.

H5: High personnel instability increases the expected proportion of medium size bud-

getary changes.

H6: High personnel instability increases the expected proportion of punctuated budgetary changes.

3.4   Data

Empirical analyses of punctuated equilibrium theory require large amounts of data. Examining rare events (punctuations) takes data sets that cover a long time span and many organizations. As such, data for this study come from a large data set of Texas school districts from 1993 to 2010–a long enough time span to examine the dynamics of punctuated equilibrium. These data provide budgetary, performance, and administrative information on hundreds of organizations (school districts) with similar goals of educating students, policy environment, and structure. This data set has been used in many other studies of punctuated equilibrium (Robinson 2004; Robinson et al. 2007; Robinson, Flink, and King Forthcoming).

The dependent variable for analysis will be the annual percentage change in instructional spending per pupil. With some limitations, school districts have discretion in how they allocate their funds across programs. Instructional spending per student is one of the core program funds for all school districts and represents one type of educational strategy that puts funds directly to educating students. Since this is one of the most important functions of districts, managers will make budgetary decisions to protect these funds from financial environmental turbulence. Meier and OToole (2009) find that when the overall budget falls, instructional spending per student is only cut a fraction compared to the overall budget change. Changes in this category represent pointed decisions by managers–they do not just reflect the availability of funds for school districts from state and local sources.

This study follows methodology proposed in Robinson et al. (2007) by dividing the budgetary variable into five categories based on the size of changes. The categories are: negative punctuations, medium negative changes, incremental changes, medium positive changes, and positive punctuations. [2]. The distribution of budgetary changes within the five categories is displayed below in Table 3.1.

Table 3.1: Distribution of budgetary changes in sample.

Change Category	Frequency	Percent
Negative Punc.	57	0.45
Medium, negative	1964	15.42
Incremental	8675	68.12
Medium, positive	1963	15.42
Positive Punc	75	0.59

N: 12,734. Kurtosis: 41.84.

There are two explanatory variables of interest in this study: organizational performance and personnel instability. The pass rate among all students on the statewide standardized test will be used to determine organizational performance. This is the customary measure of performance in the public administration literature that uses education data. Personnel instability is the percent of teacher turnover within a school district. This is another common measure in the education and public administration literature (O'Toole Jr and Meier 2003; O'Toole, Meier et al. 2009; Meier and Hicklin 2008). The lagged values of each of the measures are used in the

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[2]The exact cut point percentage values are -33, -2, 10, and 35.5. These values are the interior and exterior intersections between a normal distribution overlaid on the histogram of annual percentage budgetary changes.

empirical model. Since performance assessment and turnover typically happen at the end of a school year, it is more plausible the prior year influences the current year budgetary changes.

Revisiting the two critiques of institutional friction measures (they are only within the policy process and very stable over time), both of these variables hold up to those points. In regards to the process, both of these measures are outside of the direct decision-making process. Organizational performance should influence budgetary changes, but it is not an indicator of policy processes in the same way as other conceptualizations of institutional friction. Personnel instability is a little less clear on this issue. The measure actually assesses the stability of teachers. In public administration terms, teachers are characterized as street-level bureaucrats. While past measures of institutional friction have considered bureaucratization, it was meant to indicate a concentration of decision-making. In school districts, budgetary decisions are a top-down process that typically do not involve input from all levels of the organization. Teachers, as street-level bureaucrats, do not have a large amount of input in budgetary decision-making. Thus, this measure of bureaucratization is a measure of stability, not of centralization of decision-making power.

Fluctuations occur frequently in both of these variables, as well. For example, in the present sample, the average annual percentage change is 2.99 for performance and 13.45 for turnover. The previously studied variables of friction in this setting were organization size and centralization. To contrast with performance and turnover, the average annual percentage change for organization size is 0.75 and 0.54 for centralization. Within this sample, there are greater changes, and thus more uncertainty, for the variables of interest in this study.

To account for institutional friction measures, centralization (percent of school district's budget dedicated to central bureaucracy), centralization squared, organi-

zational size (student enrollment) and growth (percentage change in student enrollment) are included as control variables. History of punctuations in the organization (experiencing a punctuation within the previous five years) is also included in the models. These variables are also common to PET articles that use this dataset (Robinson et al. 2007; Robinson, Flink, and King Forthcoming; Robinson 2004). Table 3.2 displays the descriptive statistics.

Table 3.2: Descriptive statistics.

Variable	Mean	Std. Dev.	Minimum	Maximum
Organizational Performance	72.42	15.70	6	100
(Standardize test pass rate)				
Personnel Instability	17.47	9.51	0	100
(Teacher turnover)				
Centralization	7.39	3.71	1	73.30
Centralization Squared	68.31	125.73	1	5372.89
Organization Size (logged)	6.95	1.52	1.95	12.26
Organizational Growth	0.75	7.13	-63.30	117.33
Organizational History	No punc.:	11,911	Punc.:	823
(Dummy Variable)				

N = 12734.

3.5   Methods

This study adds to the literature that examines PET with multivariate statistical analyses (Robinson et al. 2007; Robinson, Flink, and King Forthcoming). The dependent variable (five categories of budget changes based on size) is designed to use multinomial logit as the method of analysis. Multinomial logit is used when the dependent variable consists of categories that are unordered and discrete[3]. The method calculates the probability of explanatory variables being in one category compared to a baseline category. In this analysis, the baseline category is small, incremental changes. The coefficients are to be interpreted as the medium or punctuated changes (whatever the relevant category may be) compared to incremental changes.

3.6   Results

The results of the multinomial logit model are shown in Table 3.3. [4]. The coefficients are meant to be interpreted in comparison to the baseline category of incremental changes.

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[3]Even though there is an order to the categories (positive to negative), the hypotheses are based on magnitude of the change (incremental to punctuated). This makes it unclear how to order positive and negative changes of the same magnitude. Because of this, there is no clear way to order the categories. Thus, multinomial logit is used instead of ordered logit.

[4]Diagnostic tests did not reveal multicollinearity among variables The model was estimated with robust standard errors, but the results were the same. The present study does violate the IIA assumption made for multinomial logit models. Multinomial probit was used and results were similar to the logit models. Year fixed-effects were used, but the results still held. The standardized test switched from TAAS to TAKS in 2003. The results are still robust with the exclusion of this year

Table 3.3: The effects of organizational characteristics on the relative probability of experiencing large and medium versus small budgetary changes.

Size of Change:	Negative Punc.	Medium, negative	Medium, positive	Positive Punc.
Organizational Performance	-0.234	-0.007	-0.034	-0.044
(Standardize test pass rate lagged)	-3.25	-3.79	-20.42	-6.99
Personnel Instability	0.033	0.022	-0.002	0.013
(Teacher turnover lagged)	3.91	7.86	-0.79	1.56
Centralization	-0.083	-0.223	-0.164	-0.202
	-1.29	-11.44	-8.39	-3.46
Centralization Squared	0.003	0.005	0.004	0.004
	2.18	7.37	6.25	3.41
Organization Size	-0.725	-0.470	-0.482	-1.090
(logged)	-4.99	-17.80	-17.95	-8.43
Organizational History	2.155	0.631	0.191	1.247
	6.57	6.45	1.79	4.35
Organizational Growth	0.014	0.032	-0.008	0.011
	1.47	9.24	-2.14	1.16

Z-score below each coefficient. N = 12734.

LR Test: 1730.76, p<0.00.

BIC: 21,301.385. Pseudo R^2: 0.08.

PCP: 68.75% PMP: 68.12% PRE: 1.95%

3.6.1 Results: Organizational Performance

Organization performance is negative and statistically significant in each of the categories. This means as performance improves, it is significantly less likely that organizations will experience nonincremental changes. To help illustrate the effect of organizational performance, Figure 3.1 shows the predicted probability of experiencing each of the five categories of budgetary change over the range of test pass rates. In this set of predicted probabilities, all other variables are set to their mean values. Incremental changes see dramatic growth as organization performance improves. This is consistent with Hypothesis 1. The two categories of medium size changes have unique patterns over the range of performance that give mixed support for Hypothesis 2. Medium size positive changes significantly decrease as performance improves. For organizations with less than a twenty percent pass rate, positive medium changes are the most prevalent at about a 60 percent probability. For the highest performing organizations, medium positive changes decrease probability to under ten percent. Medium negative changes do not see much of a change over the spectrum of pass rates. They are predicted to be used about ten percent of the time. Punctuated changes (positive and negative) are both very small in their predicted probabilities. In closer examination, there is little change in their probabilities over performance. This does not support Hypothesis 3.

3.6.2 Results: Personnel Instability

Personnel instability is positive and statistically significant for the negative categories of changes and insignificant for the positive changes. This means that as turnover increases, organizations are more likely to experience negative medium and punctuated budgetary changes than incremental changes. Similar to Figure 3.1, Figure 3.2 displays the predicted probabilities for each of the five categories of change

Figure 3.1: Performance with variables at means.
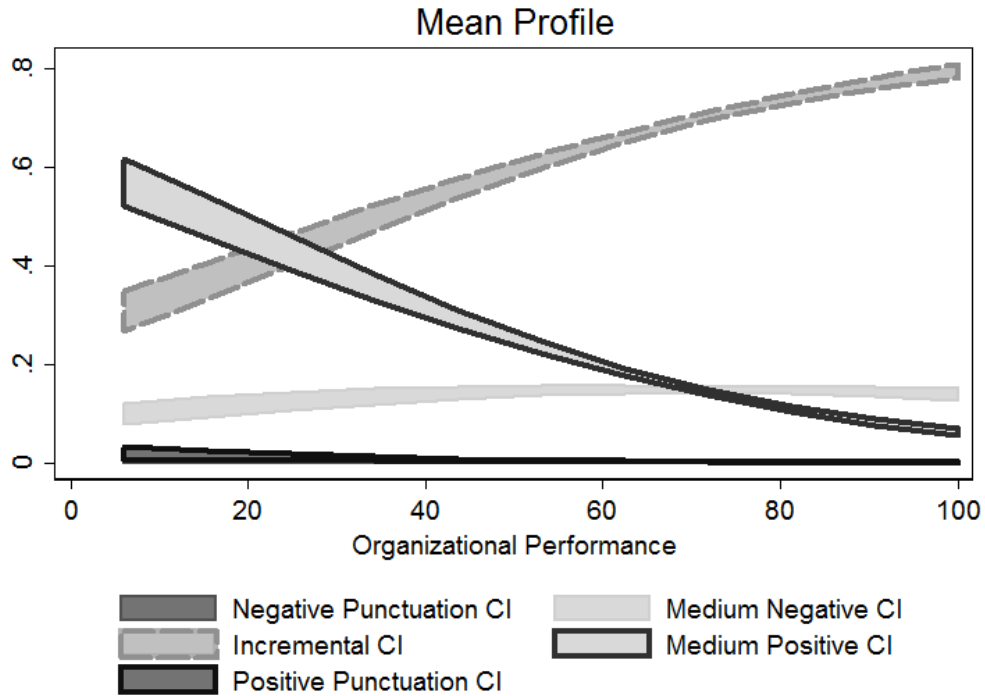
over the range of teacher turnover with all other variables held at their means. At the lowest levels of teacher turnover, incremental changes are expected about 70 percent of the time. At the highest levels of turnover, incremental changes are only expected 40 to 50 percent of the time. This declining trend supports Hypothesis 4. Hypothesis 5 again has mixed results. In support, negative medium size changes increase as personnel instability increases. Against Hypothesis 5, medium positive changes see a slight decrease as turnover increases. Punctuations were expected to increase with turnover, however, there is little support for this hypothesis.

Lastly, the control variables are examined to check for consistency with prior studies. Every variable is significant in the expected direction except centralization– it is statistically significant in the negative direction for three of the categories. This

Figure 3.2: Turnover with variables at means.
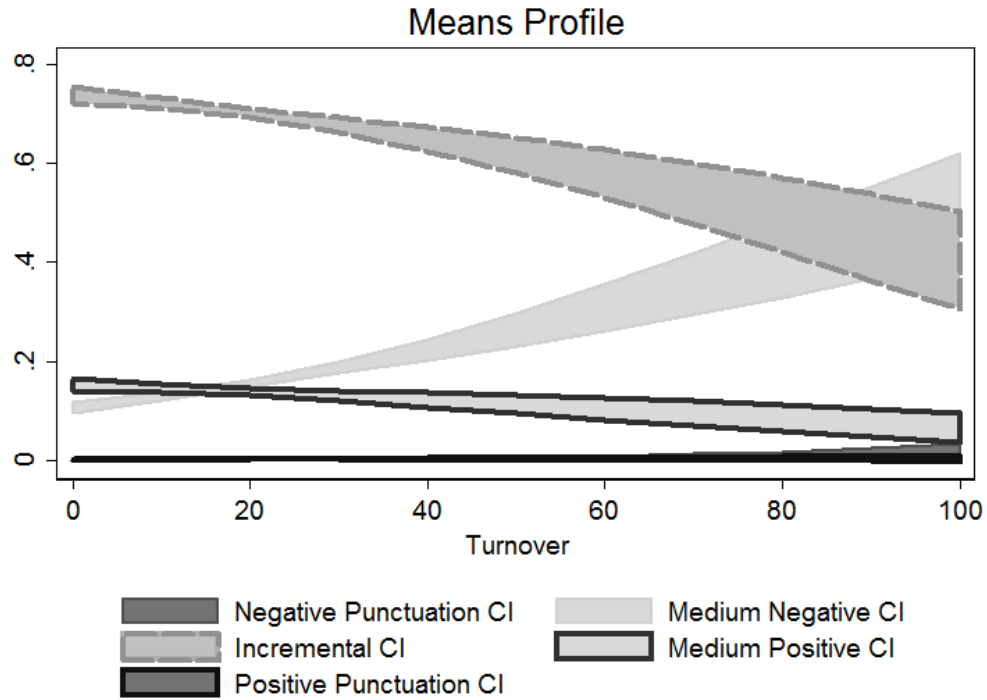
is a contradiction to past studies (Robinson et al. 2007; Robinson 2004) that have indicated an increase in centralization yields greater probabilities of nonincremental changes. However, this model contains a variable for centralization squared that is positive and statistically significant. This suggests a nonlinear U shaped relationship between centralization and budgetary changes. At higher levels of centralization, there will be a greater propensity for nonincremental budgetary changes.

3.6.3   Most and Least Punctuated Profiles

This subsection offers an extension on the predicted probability graphs for performance and turnover. Using knowledge from the literature, two new predicted probability profiles are created for each variable–a most and least punctuated profile. These are constructed by setting the control variables in the model to the first

or third quartile value, depending on what should theoretically yield more or less punctuations. Table 3.4 shows each profile below.

Table 3.4: Predicted probability profiles for most and least punctuations.

Variable	Mean	Most Punctuated	Least Punctuated
Organizational Performance	72.42	59	81.9
Personnel Instability	17.47	21.5	11.2
Centralization	7.39	9	5.5
Centralization Squared	68.31	81	30.25
Organization Size (logged)	6.95	5.7	7.7
Organizational History	0.06	1	0
Organizational Growth	0.75	0.75	0.75

Figures 3.3 and 3.4 show the most and least punctuated profiles for organization performance. In organizations where friction is high (the most punctuated profile), there are much greater chances for nonincremental changes. For the lowest performing organizations in a system with great amounts of friction, there is over a ten percent chance for a positive punctuation. As performance improves though, this probability approaches back to zero. Comparing incremental changes across the two scenarios, the predicted probability drops about 20 percent in the most punctuated profile. These results illustrate that even in these least similar policy systems, organization performance still influences budgetary stability and volatility.

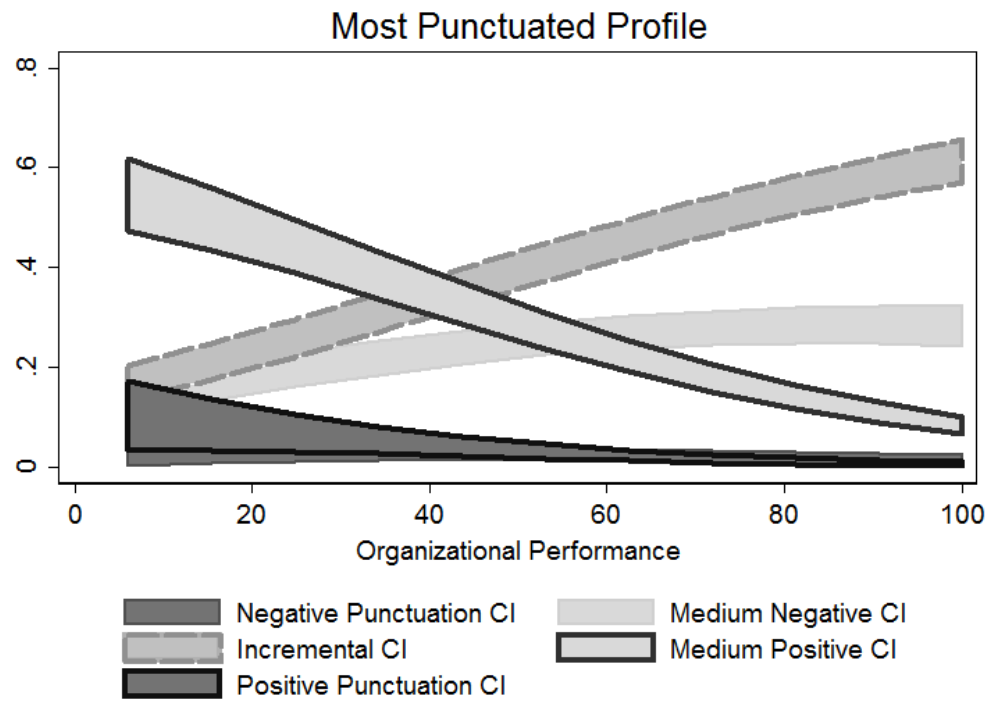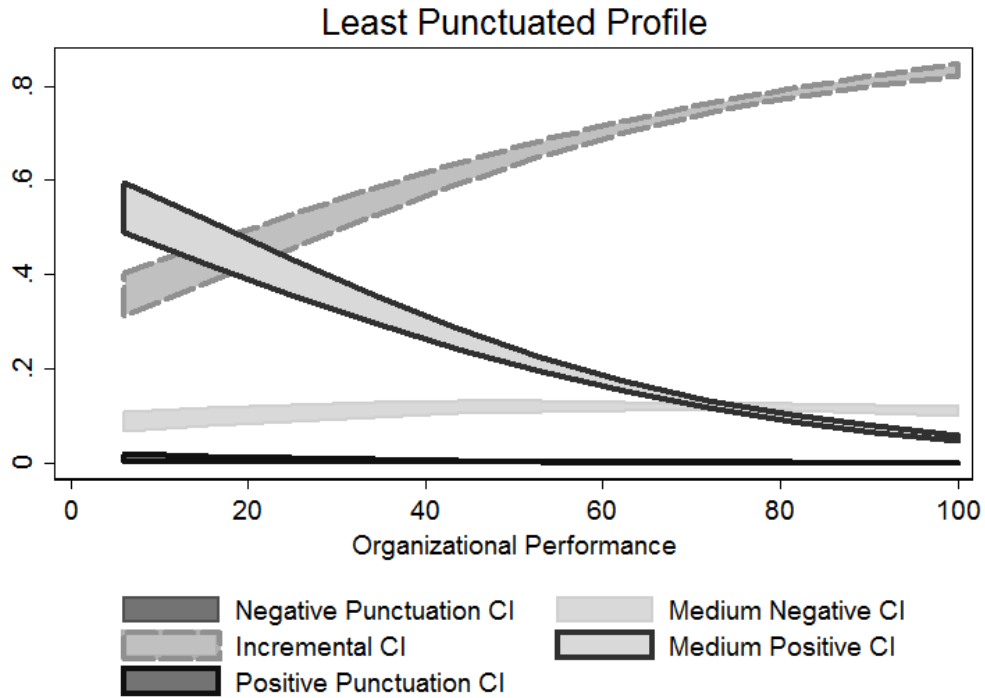Figure 3.3: Performance with variables set to most punctuated profile.

Figure 3.4: Performance with variables set to least punctuated profile.

Least Punctuated Profile

Organizational Performance

Legend:
- Negative Punctuation CI
- Incremental CI
- Positive Punctuation CI
- Medium Negative CI
- Medium Positive CI

Figures 3.5 and 3.6 show the most and least punctuated profiles for personnel instability. While the probability of incremental changes has the expected downward trend, the line overall takes nearly a 30 percent drop in higher friction systems. The probability of punctuations is nearly nonexistent in the least punctuated profile. However, there is a growing probability of punctuations as turnover increases for the most punctuated profile. Also as expected, positive and negative medium size changes are more likely to occur in the more punctuated profile. Positive medium changes decrease and negative medium changes increase as turnover grows. This shows that in either policy system, as turnover increases organizations are more likely to scale back their expenditures in this program.

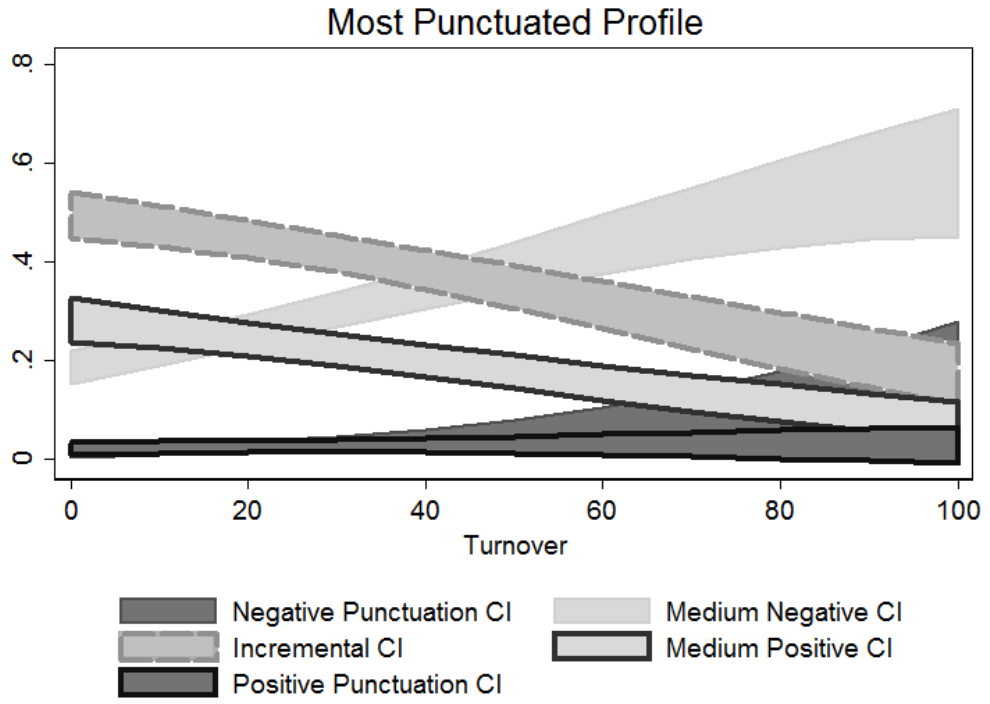Figure 3.5: Turnover with variables set to most punctuated profile.

Figure 3.6: Turnover with variables set to least punctuated profile.

Least Punctuated Profile

Negative Punctuation CI	Medium Negative CI
Incremental CI	Medium Positive CI
Positive Punctuation CI	
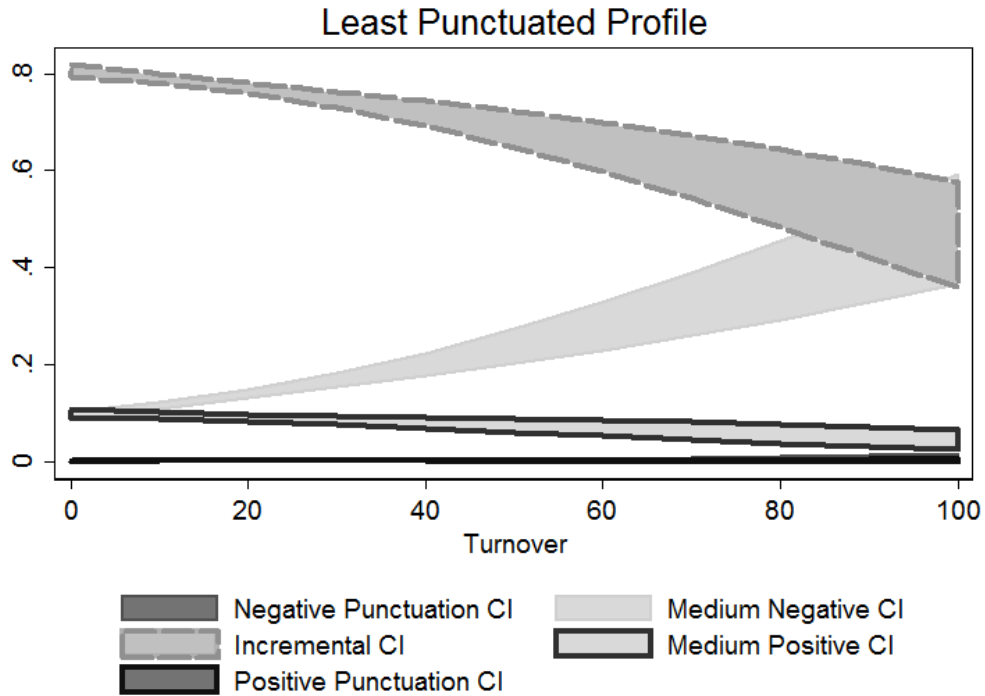
3.7 Conclusion

This study provides a broader scope to the term institutional friction by incorporating non-institutional friction measures. More than just the process of making policy, organization features can influence budgetary stability and volatility. Even with high and low levels of policy process friction, these organizational features influence budgetary changes. Theoretically, this study demonstrates how policy stability prevails amidst an unstable environment. As hypothesized, high organization performance and low personnel instability increase the propensity of incremental changes. There was little support for a change in the probability of punctuations (positive or negative) over the range of performance or turnover.

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The effect of each of these organizational features on positive and negative medium size changes was interesting. Literature typically hypothesizes that all medium size changes to have similar probabilities. This study shows that negative and positive changes occur in unique circumstances. Furthermore, the findings suggest the trends in the propensity of positive and negative changes can be opposing–one can be an upward trend while the other is a downward trend. Scholars should begin to theorize about the different situations when one might expect positive or negative changes.

There are several extensions for future studies. Analyses considered only the absolute level of performance. Future work should examine the growth hypotheses–how the changes in performance affect budgetary changes. To explain, individual organizations have unique target levels for performance. For some schools, 75 percent student test pass rate is acceptable. For another organization, 75 percent is extremely low. Perhaps a steady decline or growth in performance, whatever the absolute level may be, affects budgetary changes.

This study contributes to our understanding of budgetary change, but more broadly, adds to our knowledge of how managers address organizational issues through the budgetary process. The non-institutional exogenous factors clearly shaped the magnitude of budgetary changes. Coupling these findings with measures of institutional friction, a richer understanding of policy changes was gained. Within both punctuated and non-punctuated policy systems, decision-makers responded to environmental demands (organizational performance and personnel instability). However, across the two structures, there were clear differences in how frequently each magnitude of size of budgetary change occurred. This has implications for how organizations can address problems or make policy changes as needed. Organizations can be facing the same issues, but the structure can influence how they are addressed. While this does support the foundation of PET–structure shapes outcomes–

this study adds to this by showing that other factors outside of the structure can jolt the organization.

4. ORDERING CHAOS: THE PERFORMANCE CONSEQUENCES OF BUDGETARY CHANGES

4.1 Introduction

In today's fiscal climate, governments and organizations are no stranger to rapid budget changes. Bureaucrats and managers are expected to sustain organizational performance and stabilize operations with sudden, tight financial constraints. On the other side, budgets can be increased (or restored), calling for managers to appropriately direct funds to improve organizational performance. Different financial inputs call for unique strategies among those within the organization. In other words, organization growth and decline present different challenges.

Maintaining or improving performance in the organization is one of the most important (if not, the most important) tasks for managers. This is especially difficult with a diverse clientle with changing demands. Organization outcomes are the focus of elected officials and citizens. If performance slips, blame can quickly be directed to those in charge of and working within an organization. Prolonged poor performance can lead to job loss or sanctions placed on the organization. This increases the job difficulty for managers of organizations. Despite whatever "chaos" may come, management is expected to stabilize and bring order to the organization.

Drawing from punctuated equilibrium theory (PET), this paper examines how budgetary changes affect alterations to organizational performance. In the budgetary context, PET has demonstrated that budgets experience mostly small changes but also numerous large punctuated changes. Even with an extensive literature explaining the shape of the distribution of budgetary changes, there has been no work to connect PET to organization outcomes. This paper studies the distribution of per-

formance changes and compares it to budgetary changes to assess how organizations transfer inputs to outputs. Initial findings indicate that the distribution of performance changes is closer to a normal distribution than the distribution of budgetary changes, supporting the notion that management can create stable outputs from an organization with unstable inputs.

Although there has been much work on the consequences of financial changes on performance in the public administration and budgetary literatures, this work has not comprehensively examined all sizes of budgetary changes–large, small, positive, and negative. Academic work typically focuses on one piece or type of financial change at a time. This section considers five different categories of budgetary changes (common to empirical work in PET) from large negative to large positive to understand how they influence performance. By extending PET to consider organization outcomes, a new understanding can be gained on the connection between financial resource volatility and performance stability. Descriptive statistics, histograms, and regression analysis all support that organizations and management can normalize operations despite financial turbulence.

In the context of Texas public school districts for almost a 20 year period, the present study examines how the core performance objectives (student pass rates on standardized tests) in organizations change in light of financial changes to core program funding (instructional spending per student). In general, results indicate that organizations are able to regularize performance. Massive budget cuts, surprisingly, typically lead to only small decreases in performance. On the other side, sizable financial increases produce performance increases.

4.2   Literature

The next subsection gives a review of the policy change process in the context of PET.

4.2.1   Friction in the Policy Process

Punctuated Equilibrium Theory is centered on explaining the policy process–more particularly, how policies change over time. In an ideal world, one would expect that actual policy levels change in accordance to policy demand. This, however, does not typically occur. Punctuated Equilibrium Theory demonstrates how institutional and cognitive factors slow the policy process and prevent policy levels from acting as an efficient market where actual policy level equals policy demand. These institutional and cognitive barriers to decision-making yield policies with mostly incremental changes, but also overly large, punctuated changes. This results in distributions of policy changes that diverge from a normal distribution. This phenomenon has been extensively studied throughout this literature. The robust finding–now advocated as a general, empirical law–is that the distribution of changes in policies is leptokurtic–charcterized by tall central peaks and overly populated tails of the distribution (Jones et al. 2009).

Baumgartner and Jones (2010) brought Punctuated Equilibrium Theory to the policy process from studies in physical sciences that describe earthquakes. Just as small changes in the Earth's plates eventually lead to massive earthquakes, small un-addressed needs from policies eventually give way to massive changes. The small changes build pressure within the system until they explode as one large change.

This theory has been supported in many different contexts of policy change from incarceration rates (Schneider 2006) to election results (Baumgartner et al. 2009) and to legislative actions (i.e. bill introductions and hearings). The most popular testing

ground for this theory though has been budgetary changes (Jones, Baumgartner, and True 1998; Robinson 2004; Baumgartner, Foucault, and François 2006; Breunig and Koski 2006; Jordan 2003; Mortensen 2005; Breunig 2006; John and Margetts 2003; Jones et al. 2009; Baumgartner et al. 2009; Robinson et al. 2007).

There are two leading theoretical explanations for PET. The first is disproportionate information processing (Jones and Baumgartner 2005; Workman, Jones, and Jochim 2009). This theory simply states that issues come in and out of policy attention to citizens and officials. When they are salient, there will be more sizable changes. When issues do not have the attention of policy-makers, they will see only small, incremental changes. This pattern of over-responding and under-responding is reflected in the shape of the leptokurtic distribution found so often among policy changes.

The second reason is institutional friction. In short, the institutional processes to translate policy inputs to policy outputs impose costs on the system. Institutional barriers and veto points slow down and even impede the decision-making process. This puts friction within the policy system. The friction will yield mostly incremental changes, until the pressure builds up to burst into a large policy change, or punctuation. In general, the more decision clearances, the more friction and the more leptokurtic the distribution of changes will be.

Institutional friction has been measured in a variety of ways, including bureaucratization (broken down to centralization and organization size), stage in the policy cycle, political system (presidential or parliamentary), executive dominance, single-party governments, bicameralism, partisan control of government, partisan distance of governing parties, and decentralization (Robinson et al. 2007; Robinson 2004; Jones et al. 2009; Baumgartner et al. 2009; Breunig 2006). The presence of each

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of these features affects friction and the degree of kurtosis in the distribution of budgetary changes.

While the empirical analyses in this literature could identify the overall pattern of change, they were limited in how they accounted for punctuations as a dynamic process. Using multivariate analysis to preserve the time-series cross-sectional nature of the data, Robinson, Flink, and King (Forthcoming) test how the history of experiencing a punctuation contributes to the probability of having a punctuation in the future. The authors hypothesize two models of punctuations–the Error Accumulation and Institutional Models. The Error Accumulation Model states that a history of a punctuation will lower the probability of experiencing a punctuation in the future. In this model, punctuations occur to meet a pent up demand for change. Once met, processes continue incrementally until the need for another large change. The Institutional Model states that a history of a punctuation gives a higher probability that a punctuation will occur in the future. This model attributes punctuations to poor organizational design and mismanagement that cannot find stability. Their results support the Institutional Model–punctuations occur in clusters.

4.2.2   Budgetary Literature–The Connection Between Financial Resources and Performance

In punctuated equilibrium studies, budgets are treated as an output. This is also common among classic works in the budgeting literature (Davis, Dempster, and Wildavsky 1966, 1974; Wanat 1974). However, budgets are also inputs for the workings of governments and organizations. There is a purpose to the dollar amount allocated for specific programs–they are (generally) made with the intent of improving or maintaining performance. Thus, only viewing budgets as an output series misses

a crucial element to the study of the policy process–how resource volatility influences core institutional functions.

It is largely unknown in the punctuated equilibrium literature how well bureaucrats are able to hold their performance and efficiency despite disruptions to the policy process–specifically disruptions in financial resources. Environmental shocks happen all of the time–no person (let alone bureaucrat) is privileged to a completely stable and predictable work environment. Bureaucrats must work the best they can with more, less, or about the same amount of money available in their agency. Citizens expect stable or improving levels of performance despite shrinking budgets. Skilled organizations can maintain their work alongside these setbacks.

The connection between resources and organizational output is a crucial part of the policy process and has direct implications for citizens. Theories of financial resources' impact on performance are based on the budgetary control hypothesis– that budgets can be used as tools of political control (Carpenter 1996). It stipulates that organizations and agencies will increase or decrease their work based on their financial resources. The causal mechanism of this, however, was initially unclear– was it truly the dollar amount altering actions or was it the signal sent by the budgeting authorities through financial alterations? In his study of the Food and Drug Administration and Federal Communications Commission, Carpenter (1996) finds that the signal of budgetary changes is more important than the actual dollar amount in altering agency productivity and output. In other words, the budget in its actual dollar amount has limited impact on manipulating agency actions.

In public administration work, there is tension among literatures as to the effect of resource changes on performance. While some scholars of public administration contend that change and reform stimulate organizations to improve (Osborne and Plastrik 1997; O'Toole Jr and Meier 2003), others believe stability in resources will yield

steady organization output gains (Weber 1946). Andersen and Mortensen (2010) address this question of whether resource stability or change advances the organization. By examining how budget stability impacts the absolute level of performance in public education in the Danish school system, the authors find that budgetary stability and incremental financial growth are the keys to high organizational performance.

Taking into account Andersen and Mortensen (2010), there has been limited work as to how budget increases affect organizational performance. The general thought is that increases to budgets will increase organization productivity and performance (Boyne 2003; Carpenter 1996; Andersen and Mortensen 2010). This point, however, is contested by other scholars that argue the added resources are absorbed by the bureaucracy instead of being directed towards organizational output (Downs and Corporation 1967; Niskanen 1971).

Aside from budget increases, a major focus of this work has been on how performance fluctuates amidst budgetary cuts. Budget cuts are just one type of organizational decline that has been studied throughout cutback management literature. Faced with financial constraints, organizations will find it harder to adapt to new demands, innovate to progress the organization, or retain personnel (Levine 1978). Each of these components is necessary to improve organization outcomes.

Meier and OToole (2009) examine the affect of environmental shocks (in this study, large decreases in a budget) in Texas school districts and examine how school performance is affected on a variety of indicators. The authors find that performance on the state wide standardized test is relatively unaffected by budget cuts. Other performance indicators (Anglo test score results, percentage of students who took ACT/SAT exams, and the percentage of students who scored above 1110 on SAT or ACT equivalent) did see negative impacts from financial setbacks. The authors contend that overall district performance is maintained by managerial choices on how

to absorb the negative budget shock. In further analyses, they find that managers protected the money allocated to instructional spending by buffering it from the larger budgetary shocks. In other words, managers will choose to take proportionally more funds from other programs to maintain current spending levels of instructional expenditures.

Outside of the education context, federal agencies have been analyzed for how they complete activities despite budgetary cuts. In their study of the EPA, Wood and Waterman (1994) showed that monitoring and abatement activities were able to recover from massive budget cuts and even eventually increase to the highest levels in agency history. The agency was able to garner enough slack resources (beyond more financial resources) to increase productivity.

4.3 Theory

In PET literature, there has been much work to understand the causes of the friction, but little to understand the consequences of friction on the provision of public goods. How does friction in the policy process translate to organizational performance? To use the earthquake metaphors–we know that the earthquake occurred. What we don't know is the aftermath of that earthquake. In the government and organization context, we do not know how the presence of major policy shifts affect the performance of governments. There must be consequences of "earthquakes" in organizations. Earthquakes disrupt real life and have consequences for society. How do massive policy changes impact public organizations' ability to maintain core performance?

The first part of this study examines the shape of the distribution of annual percentage performance changes. This question ties directly to how policy process friction translates to organization outputs. Literature that aims to explain organi-

zational performance has found that performance is similar from one year to the next–in other words it is autoregressive (O'Toole and Meier 1999). Given this, it is expected that the distribution has a tall central peak of small changes, similar to a leptokurtic distribution.

However, the distribution of performance changes could absorb some of the friction in budgetary alterations through implementation. Since performance is not directly linked to the sources of friction from the policy process, it will not be as punctuated. As explained above, one of the goals of management is to stabilize output processes–this will result in fewer performance punctuations compared to the budgetary process with more friction. This is also supported by budgetary literature outside of PET that has demonstrated how bureaucrats and managers work to implement their desired level of performance despite budgetary changes.

This work also empirically tests how different magnitudes of budgetary changes influence performance changes. There are five hypotheses based on different magnitudes of budgetary changes. This categorization of budgetary changes has been used throughout PET literature (Robinson et al. 2007; Robinson, Flink, and King Forthcoming). As an extension to the literature, unique expectations for negative and positive budgetary changes are specified [1]. As is evident from the literature and from theoretical ideas, negative and positive budgetary changes should yield different reactions from managers and organizations. Theoretically, it is expected that managers and organizations will dampen the effect of overly large input changes as they translate to outputs. Thus, overly large budgetary changes should yield less dramatic performance alterations. Medium and incremental changes could more easily be absorbed to the organization and not result in sizable performance changes.

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[1]Thus far, the literature has only specified hypotheses based on the magnitude of the size of the change, not the direction positive or negative.

4.4   Hypotheses

This leads to the hypotheses:

H1: The distribution of annual percentage performance changes will be leptokurtic.

H2: The distribution of performance changes will have a lower kurtosis value than the distribution of budgetary changes.

H3: Large negative budgetary changes will lead to smaller negative performance changes.

H4: Medium negative budgetary changes will lead to incremental performance changes.

H5: Incremental budgetary changes will lead to incremental performance changes.

H6: Medium positive budgetary changes will lead to incremental performance changes.

H7: Large positive budgetary changes will lead to smaller positive performance changes.

4.5   Data and Methods

Data for this study come from Texas school districts from 1993 to 2010. This data have been used in other studies of punctuated equilibrium (Robinson 2004; Robinson et al. 2007; Robinson, Flink, and King Forthcoming). Texas school districts all have a similar organizational structure and policy environment. At their foundation, though, they all share the same goal of educating students. This makes these organizations comparable for empirical analyses. The data set contains budgetary, student performance, and administrative information on hundreds of these organizations (school districts). The timespan taken together with the large number of organizations create a large enough dataset to test for the rare events (punctuations) in this study.

The dependent variable for analyses is the annual percentage change in the school district all student pass rate on the annual standardized test [2]. This performance

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[2]TAAS replaced TAAS in 2003.

measure is one of the main focuses for schools. It has become one of the most salient features of a district. Achieving high performance on this test can reward districts, while poor performance can lead to negative consequences.

The budgetary measure for the independent variable is the annual percentage change in instructional spending per student. This expenditure represents the core function of schools–to educate students. This is the program budget that districts will work to buffer from environmental shocks (Meier and OToole 2009). Thus, the budgetary measure in this is an essential element to success in school districts. It is also commonly analyzed as the budget of interest in other works in this literature (Andersen and Mortensen 2010; Robinson et al. 2007; Robinson, Flink, and King Forthcoming).

Both of these measures (budget change and performance change) will be used to address Hypotheses 1 and 2. Simple tests on the normality and kurtosis value of the distributions on each of these variables will assess the shape of the distributions. This is the common empirical test throughout PET literature–the higher the kurtosis value, the more friction is present in the policy system.

To analyze Hypotheses 3-7, the budgetary change variable is divided into five categories based on the size of the budgetary change–positive and negative punctuation, positive and negative medium size change, and incremental changes. This is in accordance with the theoretical and empirical work in PET. The percentage change threshold to divide the categories was determined using the method from Robinson et al. (2007) in which a normal distribution is overlaid on the histogram of budgetary changes. The four intersections between the histogram and normal distribution divide the budgetary variable into five categories. The percent boundaries and frequencies for each category are shown in Table 4.1.

Table 4.1: Categories of budgetary changes.

Budget Change Category	N	Percent
Negative Punctuation (<-33)	125	0.67
Negative, Medium (-33 to -2)	2765	14.85
Incremental (-2 to 10)	12,674	68.05
Positive, Medium (10 to 35.5)	2871	15.41
Positive Punctuation (>35.5)	190	1.02

Distributions of performance changes for each of the five categories of budgetary changes serve as initial analyses of Hypotheses 3 - 7. These five distributions give a visual of how performance responds to different magnitudes of budgetary changes. It is expected that the distributions for medium (positive and negative) and incremental changes will have smaller performance changes than punctuated budgetary changes.

Lastly, regression analysis is conducted to examine Hypotheses 3-7. The dependent variable is annual percentage performance change. There are four independent variables of interest–dummy variables for each category of budgetary change (incremental is the base category). Several control variables are included that are expected to influence the standardized test pass rate. First, instructional spending per student is added to the regression. The absolute level of funding–as opposed to changes–is expected to influence performance. Typically, the more financial resources, the better the performance. Teachers also affect student performance. Controls for teacher experience (count variable of the number of years of experience) and teacher turnover (percent of teachers in school who do not return the next school year) are added to the regression. To assess the size of the district, student enrollment is included. Stu-

dent attendance rate is added to the regression–students must attend class to learn the material and do well on the standardized test. The percentage of funds spent on central administration (and that value squared) is controlled for as a measure of institutional structure. Lastly, a dummy variable for the year 2003 is added because the standardized test changed from TAAS to TAKS in that year. The change of test caused a decrease in test scores across all districts.

4.6   Results

4.6.1   Distribution of Performance Changes

Figure 4.1 shows the distribution of annual percentage performance changes. This figure supports Hypothesis 1. Since the kurtosis value is greater than 3 (the value for a normal distribution) the distribution is leptokurtotic. This is also seen visually in the histogram since it is greater in the central part and tails of the distribution than the normal distribution. This means that friction is translated to performance from the policy process.

Figure 4.2 lends support for Hypothesis 2–the distribution of performance changes is much less kurtotic than the distribution of budgetary changes. The kurtosis value for the distribution of budgetary changes is more than double the value of performance changes. This finding indicates that there is much less friction in performance outcomes than in budgetary decisions. Implementation absorbs part of the volatility from budgeting decisions. In many ways, this is a positive outcome for the work of public management. Managers are able to take a friction-filled process and create less volatile outcomes–a desirable skill for the organization.

Figure 4.1: Distribution of performance changes.
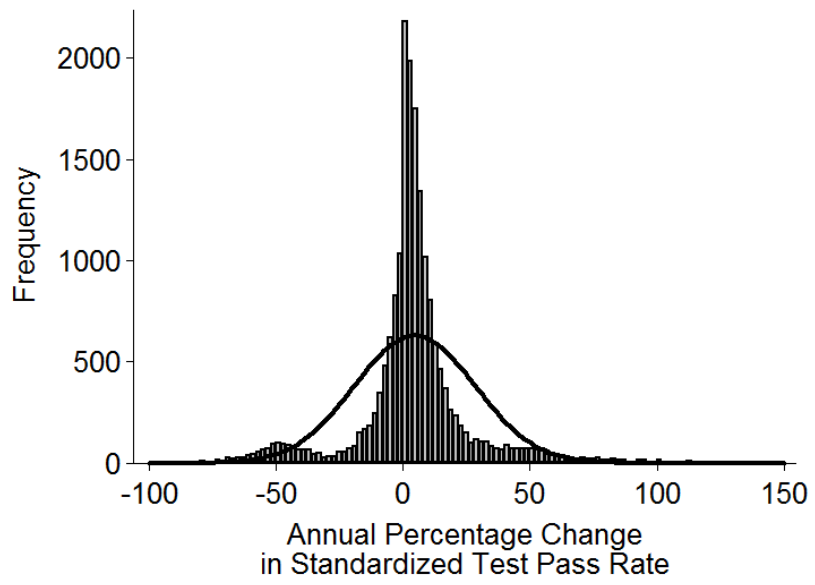
Kurtosis = 8.68

Figure 4.2: Distribution of budgetary changes.
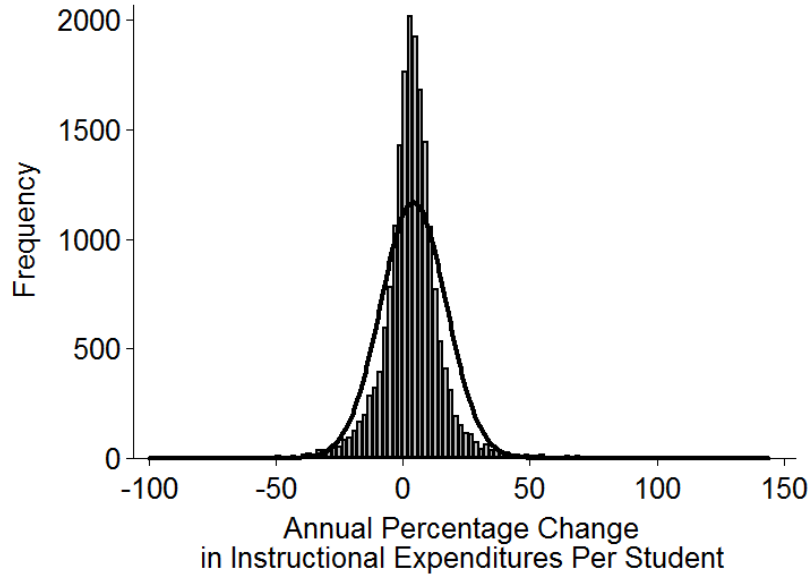
Kurtosis = 18.32

4.6.2 Budgetary Changes Effect on Performance Changes–Distribution Analyses

The next set of empirical tests examines how different size budgetary changes impact performance changes. Figure 4.3 shows the distribution of annual percentage performance changes by the category of budgetary change and Table 4.2 shows the mean and standard deviation of each distribution. Even from these simple distributions and descriptive statistics there are some surprising findings. Negative budgetary punctuations that are cuts greater than 33 % result in only a 1.34 % decrease in performance. This shows great resiliency from management and the organization to buffer a severe environmental shock. Positive punctuations (greater than 35.5 % increase in spending per pupil) yields on average a 12 % increase in performance. However, budgetary punctuations (positive and negative) lead to uncertainty in performance changes as well–the standard deviation is quite large. Although the spread

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is wide in both distributions, there is a clustering of values around small incremental changes.

The medium and incremental categories all produce positive average performance changes and a clustering of observations around small incremental changes. Positive, medium changes seem to produce the greatest performance gains. Negative, medium changes (-2 to -33 %) are barely above zero. All three of these categories have smaller standard deviations–the smaller changes seem to give a little more certainty in performance. Taking together Figure 4.3 and Table 4.2, this gives preliminary support for Hypotheses 3-7.

Figure 4.3: Distribution of performance changes by budgetary change category.
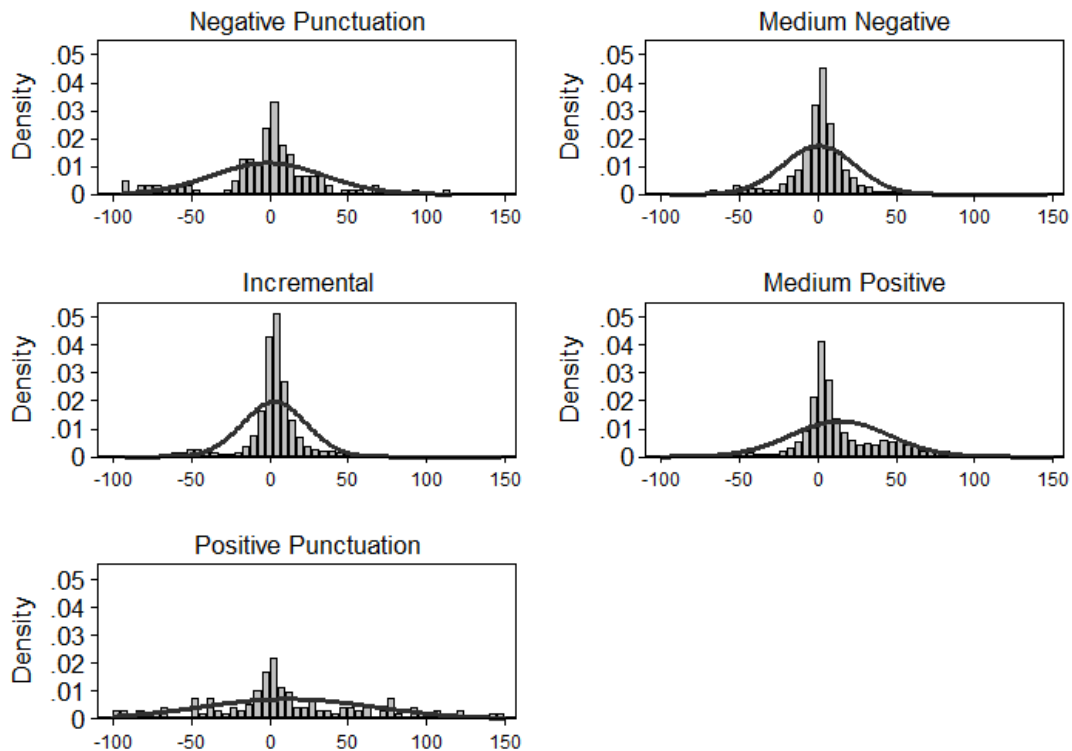
Table 4.2: Descriptive statistics of performance change by budgetary change category.

Budget Change Category	N	Perf. Change Mean	Std. Dev.
Negative Punctuation (<-33)	125	-1.34	35.73
Negative, Medium (-33 to -2)	2765	0.81	23.01
Incremental (-2 to 10)	12,674	3.18	20.36
Positive, Medium (10 to 35.5)	2871	14.29	31.42
Positive Punctuation (>35.5)	190	11.79	55.74

4.6.3   Budgetary Changes Effect on Performance Changes–Regression Analysis

Table 4.3 displays the results of the regression analysis. Of the four categories of budgetary change, three are statistically significant. The occurrence of a positive budgetary punctuation is expected to improve performance almost 14 percent compared to an incremental budgetary change. Medium positive budgetary changes are expected to increase performance about 9 percent. Medium negative budgetary changes, on the other hand, have a negative impact on performance compared to an incremental budgetary change. Negative punctuations are not statistically significant–this means that it does not have a different affect on performance changes than an incremental budgetary change. All of the control variables are statistically significant as well.

Connecting these regression results to Hypotheses 3-7, there are mixed results for whether the Hypotheses are supported or not. Hypotheses 3, 4, 5, and 7 all generally find support. Hypothesis 6 finds limited support–medium positive changes actually seem to increase performance greater than incrementally. Taken together, the findings in this study show how management and organizations work to provide stable

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outcomes despite unstable inputs. However, they are also able to take advantage of positive budgetary changes and improve organization outcomes. This is evident by the sizable performance gains when budgets increase.

Table 4.3: The effects of budgetary changes on organizational performance changes.

Variable	Model 1
Negative Budgetary Punctuation	-3.77 (1.94)
Negative, Medium Budgetary Change	-2.94** (0.43)
Positive, Medium Budgetary Change	9.21** (0.42)
Positive Budgetary Punctuation	13.79** (1.57)
Instruction Spending per Student	-0.00** (0.00)
Teacher Experience	-0.39** (0.10)
Teacher Turnover	-0.15** (0.02)
District Enrollment (logged)	-3.02** (0.91)
Attendance	-1.04** (0.18)
Centralization	-1.38** (0.11)
Centralization Squared	0.02** (0.00)
Year 2003	-57.63** (0.58)
Constant	146.39** (17.51)

Base Category is Incremental Budgetary Changes.

Standard Error in parentheses. Regression with fixed effects.

$R^2 = 0.37$, N = 18625.

* = p¡0.05, ** = p¡0.01

4.7   Conclusion

PET has focused on explaining the policy process through institutional and cognitive factors. The literature has robustly demonstrated that policy changes are mostly incremental, but also subject to large changes known as punctuations. What is missing from this literature is an understanding of the consequences of policy changes on organization output. This is one of the contributions of this section–extending PET to explain organization performance.

In the context of Texas school districts, this paper studies how budgetary changes influence performance. One task of managers is to take the altering inputs of the organization and translate them to smooth and consistent organization outputs. This study supports this idea–the findings suggest that performance changes contain less friction and a lower kurtosis value than budgetary changes and that the organization can preserve performance despite negative budgetary shocks. These findings have repercussions for organizations that are trying to keep stable performance amidst an unstable financial environment.

There are a few notable limitations of this study. For one, the output studied in this paper does not exactly conform to the budgetary control hypothesis. It is unlikely that anyone wants the standardized test pass rate to decrease in any school district. This study could be extended to other agencies that have work where different "principals" have different expectations.

The regression model can also be extended to include other control variables that can affect performance changes. There is a rich literature in public administration and education literatures about school factors that influence the absolute level of performance, but not performance changes. Thinking theoretically about what cause

instability in outcomes can progress our understandings of how organizations can sustain their work.

Future works can also examine how skilled bureaucracy or management can mitigate the affects of financial cutbacks on organizational outputs. This work calls for an interaction between resources and organization personnel. Perhaps better trained workers are able to maintain performance despite budgetary cuts or make greater improvements with only small budget increases.

5. CONCLUSION

5.1 Introduction

Fiscal concerns are part of every government and organization. Public agencies need funds to provide goods and services to citizens. In addition, the stability of those funds shapes how managers and workers within organizations approach their jobs. One strand of budgetary literature explains the budgetary process. It not only identifies an overall pattern of change, but examines organizational structures that produce smaller or larger budgetary changes. Organizations need money to complete their work for society and managers face hard decisions on how to allocate those financial resources.

At the foundation of budgetary process literature, incrementalism states that budgets will have small changes over time. This theory has been supported in many different contexts over the decades of research. Embracing incrementalism, punctuated equilibrium theory recognizes that budgetary changes will be mostly incremental. However, punctuated equilibrium also accounts for large, punctuated changes that occur in the budgetary process (something incremental theory could not do). This pattern of change (incremental and punctuated) has also been seen in many different budgets from local, state, and federal governments.

These literatures are now progressing from simply identifying a pattern of change (incremental and punctuated), to examining the organizational structures and other features that contribute to more or less punctuations. Institutional decision-making structures and cognitive limitations are the main theoretical reasons identified in PET literature. This theoretical push is also coupled with improving empirical methods in this literature. Thus far, univariate analyses have dominated the field. Scholars

are now applying multivariate hypothesis testing to the study of budgetary changes. These methods enhance our understanding of how multiple aspects of organizations all influence budgetary decision-making.

The goal of this dissertation is to add to the knowledge of the public budgetary process. Particularly, work for public administration literature is used to explain budgetary changes. This work can help inform public managers, organizations, agencies, and officials about factors that influence budgetary stability and volatility and what the consequences are for organization performance. Public organizations are part of the everyday lives of citizens. A better understanding of their work can help to improve outcomes for society.

The empirical analyses are performed using data from Texas school districts. This data provide a good setting for empirically testing punctuated equilibrium theory. For one, the data set is large enough to observe punctuations, which are rare events. Also, this data consist of thousands of organizations with similar goals and policy environment. Each district exercises control over their budgetary allocations as well.

This dissertation first, discusses all the ways budgetary changes are characterized by scholars. It also demonstrates how organizational features (standardize test pass rate and personnel instability), influence budgetary changes on core activities (instructional spending per student). Lastly, this dissertation examines the consequences of budgetary changes on performance changes. A full discussion of key contributions of this work is in the subsection below.

5.2   Review of Key Contributions

One of the key contributions of this dissertation is a synthesis of conceptualizations and measurement of budgetary changes. This literature has expanded in breadth rather than in depth. As a consequence, it has missed a central under-

standing or common language among scholars in the field as to what is and is not incrementalism. Although it is unlikely that scholars will ever agree on one common conceptualization of incrementalism, they can implement language into their work to describe the type of change they are examining in their work.

In examination of the literature, there have been many types of incrementalism. I consolidate these to four unique types: relative, procedural, mathematical, and political incrementalisms. Relative incrementalism occurs when programs have the same ranking (lowest to highest budgets) from one year to the next. If one program surpasses another in the dollar amount allocated to it, relative non-incrementalism occurs. Procedural incrementalism happens when the process to set the budget stays the same from one year to the next. If there is a change in the process or balance of decision-making among actors from one year to the next, procedural non-incrementalism occurs. Both mathematical and political incrementalisms analyze the annual change in budgets. If the budget changes are examined from zero, this is mathematical incrementalism (if the change is close to zero). If the budget changes are compared to the previous year's budget change, this would be political incrementalism or non-incrementalism, depending on the size of the change.

Each of these typologies represent unique conceptualizations and measurement schemes. Which method scholars use to characterize budgetary changes has repercussions on what observations will be classified as incremental, non-incremental, and punctuated changes. This will greatly impact the conclusions scholars draw from their studies. Thus, when scholars try to compare their findings to published work, the comparisons may not be appropriate. It depends if each researcher is examining the same type of incrementalism.

Another contribution (particular to Section 3) is the theoretical development of non-institutional friction (measured by district performance on the standardized

test and teacher stability) as a catalyst for budgetary changes. It is commonly known in public administration work that both performance and worker retention are important objectives for managers. If any one of these components drop, it puts stress into the organization. These theories, though, had not been tested in punctuated equilibrium theory which states that friction and stress in an organization will lead to more volatile policy (measured through the budget) changes.

As is common to the punctuated equilibrium literature, variable for annual percentage budgetary changes was split into five categories based on the magnitude of the size of change–negative punctuation, medium negative, incremental, medium positive, and positive punctuation. This was used as the dependent variable in multinomial logit modeling. The budget analyzed was instructional spending per student. This budget represents one of the core functions of school districts–educating students in the classroom.

Controlling for a variety of variables identified in punctuated equilibrium literature (for example, institutional friction and organization history), performance and personnel turnover (the measures of non-institutional friction) have statistically significant affects on budgetary changes. The results indicate that as performance increases, incremental changes become more prevalent. The is theoretically expected because when the organization is performing well, there is little demand for change. On the other side, when performance is low, fewer incremental changes are expected. This means there is friction and demand for change in the organization.

Personnel instability also had statistically significant results for negative punctuations and negative medium size changes. With regards to incremental changes, as turnover increases there are fewer incremental changes. As personnel becomes more stable, there is a greater probability for incremental changes. For public organiza-

tions overall, this means that efforts to achieve high performance and retain workers can see improvements in budgetary stability.

One of the most striking findings from Section 3 is the movement of probability of medium size changes in the predicted probability graphs. PET has exclusively focused on explaining punctuations. However, there is no statistically significant effect across performance or personnel turnover of punctuations becoming more or less probable. It seems they are equally likely to occur (at a very low probability) across any amount of friction. Most of the action or trade off of incremental changes comes from medium size changes. It is easier for budgetary actors to make medium size changes than punctuated changes. More attention should be given to theorizing about medium changes, since they do experience more alterations in probability than punctuations. Given that punctuations do not occur very often and do not have statistically discernible changes across the friction variables considered in this dissertation, perhaps there is too much emphasis on explaining them within the policy change literature.

Another important finding in Section 3 is the difference in the slope of the probability between positive and negative medium size budgetary changes. Literature has focused on the magnitude of the change, not the direction. It was assumed both positive and negative changes of the same magnitude occur with the same probability. The graphs in Section 3 show how positive and negative changes behave very differently–each have distinctive slopes across the predicted probabilities. In the predicted probability graph on performance, medium positive changes have negative slope while medium negative changes are relatively flat. In the graph for personnel turnover, medium negative changes have a positive slope and medium positive changes have a negative slope.

This is a clear indication that scholars need to theorize about the differences between positive and negative budgetary changes to better understand the budgetary process. These type of changes are caused by unique factors in organizations. Also, in a practical sense, an increasing versus decreasing budget have different implications for how management runs public organizations. Organizations with steadily decreasing funds have to utilize cost-saving techniques or restrict their work. Organizations with increasing funds are better situated to expand and improve their public services.

This leads to the key findings of Section 4–performance outcomes keep relatively stable despite large budgetary changes. By studying the impact of the five categories of budgetary changes on changes in organization performance, results indicate that when the organization experienced a large budget cut, performance dropped only a small amount. This speaks to the ability of managers and those in the organization to maintain their work with environmental turbulence. On the other end, managers were able to capitalize on large budget increases and see immediate sizable gains in performance. This means that management and the organization are able to buffer the negative impacts of budgetary cuts and take advantage of budgetary increases to advance their organization. These findings show great promise for organizations experiencing fiscal uncertainty–they can still maintain their performance despite budget fluctuations.

5.3   Limitations, Improvements, and Extensions

While this dissertation moves the understanding of budgetary processes forward, there are limitations to these findings. For one, causality is still questionable. While Section 3 demonstrated how performance (lagged) influences budgetary changes, Section 4 examined how budgetary changes influence performance. Using granger

causality tests on data with many groups has theoretical limitations. In this case, there are over 1000 school districts studied. Perhaps some school districts have the causal arrow going one way, while many other school districts have the causal arrow pointing the other way. It is difficult to really assess causality in this case. The causality tests conducted indicated statistical significance in both directions. Perhaps the next step in understanding what factors influence budgetary decision-making, interviews with superintendents and school board members would be appropriate. Within the budgetary literature, scholars have recently acknowledged this qualitative shortcoming.Talking with public officials can shed some light on how budgetary decisions are made.

PET is referred to as a class or group theory in that hypotheses are about the magnitude of a change as either incremental or punctuated. In empirical work, though, this grouping masks variation and limits theoretical development. This variation can lead to deeper understandings of the budgetary process. However, moving PET away from this grouping takes away the basic principles at the foundation of the theory. Although it has been advocated for PET to progress beyond "arbitrary" thresholds, it is unclear how *punctuated* equilibrium theory would exist without a defined category of punctuations.

This work could be improved by adding more to or examining other variables in the empirical models. The budget of interest in this dissertation is the core function for these organizations–instructional spending per student. However, how would institutional and non-institutional friction affect funds directed for minority groups? In the education setting, how do bilingual education funds fit into the PET framework? It would be expected for these funds to have larger fluctuations since in many districts, this is not a top priority for expenditures. This would vary by the number of bilingual student in a district. Does a greater number of students

who demand this services lead to less fluctuations? Will managers work to stabilize the funds for these minority issues? This is a question that can be addressed in the Texas schools data set.

Future research can also examine the hierarchical aspects of the budgeting process on budgetary changes. Do changes in the federal level trickle down to changes in the state and local levels? Or how does friction at the state or federal level effect incremental and punctuated changes at the local level? It is theorized that less punctuations occur as the level of hierarchy increases. Does this empirically hold true?

This study would benefit by being applied to other public organizations and policy domains outside of the education setting. While the data in Texas school districts provide a nice context for this dissertation, the results could be unique to the education arena. Testing these theories in other public policy areas (for example, health) would lead to a better understanding of the budgeting process in different policy fields.

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