PATTERNS OF GRADUAL CHANGE IN PUBLIC POLICY

Thesis submitted for the degree of
Doctor of Philosophy

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Submitted to the Senate of the Hebrew University of Jerusalem
December, 2016

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Abstract

The dissertation's main subject of inquiry is the theoretical discrepancy between policy process theories that describe a punctuated equilibrium (PE) dynamic of policy change, such as multiple streams (MS) (Kingdon [1984] 1995), advocacy coalition framework ACF (Sabatier and Jenkins-Smith 1993) and PE theory (Baumgartner and Jones 1993), on the one hand, and case studies that describe processes of gradual policy change (Capano 2003; Cashore and Howlett 2006; 2007; Chaqués and Palau 2009; Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Kay 2011; Howlett 1994; Skogstad 1998; Weaver, 2010) on the other hand. Disproportional information processing theory (DIP) (Jones and Baumgartner 2005), PE's behavioral theory, is the dissertation's main theoretical framework.

More specifically, the dissertation aims to advance our understanding of gradual changes by focusing on the following questions:

A. Do gradual and accumulating policy changes occur across different levels of policymaking?
B. What are the characteristics of gradual and accumulating policy changes?
C. How do patterns of gradual and accumulating policy changes fit in the general picture of PE patterns of policy change, with regard to incidence as well as change dynamics?
D. Can DIP be refined or expanded to account for patterns of gradual and accumulating policy changes?

To address these questions the dissertation is comprised of three articles that analyze gradual policy change at three levels: a high-resolution study of air pollution policy in Israel from 2002 to 2004; a macro-level study of US federal budget changes from 1947 to 2014; and a longitudinal meso-level study of air pollution policy and road safety policy in Israel from the 1960s to 2007. Due to the inherent differences between the levels of analysis distinctive methodologies were developed for each scale.

The three articles address the four questions in several ways: With regard to question A, the articles present a unified finding that gradual changes occur at all levels of policymaking, from small accumulating changes in the regulation of air pollution to large scale budget changes. This finding, together with the case studies cited above provide a substantial basis for generalizing the multi-level occurrence of gradual and accumulating policy change for other Western democracies and for a wide array of policy fields.

With regard to question B, the first article shows the significance of *sequencing* in order for a series of policy changes to accumulate. This provided the basis for defining *policy sequences*, series of non-major changes accumulating to significant change over time. The article also shows that identifying policy sequences and assessing their significance requires analysis of policy change content. A method for this was developed and applied to the case of air pollution policy in Israel, and proved efficient for differentiating between policy changes which accumulate to significant change over time and those that do not.

With regard to question C, the second article shows that in the US federal budget between 1947-2014, in 60 categories of spending consistently defined over time, more than 60% of annual changes were in trending series of four years or more. The finding attests the central role of trending series of budget changes. It is also a strong indicator of high incidence of trending changes in other types of policy changes generated by public decision makers. In addition, and most importantly, the article suggests a resolution to the theoretical discrepancy between PE patterns of changes and gradual patterns of change. We find that gradually accumulating change occurs, though in a general unidirectional PE dynamic characterized by inefficient decision-making. This means that even if policy is progressing in a certain direction over an extended period of time, decision makers still find it difficult to respond in a proportional manner.

A complementary facet of this theoretical resolution is shown in the high resolution and meso-level articles. Although PE patterns, directional or not, are the general rule, there still may be periods of more gradual and proportional change. Such a policy sequence is best demonstrated in the third article in the case of vehicle air pollution in Israel from the late 1990s to the mid first decade of the new millennium. During this period policy substantially advanced without any major changes taking place. The two facets of the resolution explain how the political landscape can appear both stagnant and volatile at the same time, while subtle changes are also taking place.

With regard to question D, the first and third articles suggest refining DIP to accept that gradually accumulating changes may emerge when signals point in a certain direction of policy over an extended period of time. In addition, findings in the third article suggest refining DIP to accept that gradual and more proportional change may occur when there is a gap between the level of signal strength and institutional friction, with the former strong enough to drive non-major changes and the latter weak enough to allow for gradual accumulation over time. Finally,

within policy areas in which change generally progresses in a certain policy direction over time, findings from the third article suggest that the interplay of signal strength and institutional friction generates four archetypal patterns: slow incremental, gridlock, frequent punctuations and infrequent punctuations with specific findings validating the first three pattern types. These suggested refinements relate to DIP's theoretical core as they concern two main factors in DIP that account for PE patterns of change – signal strength and institutional friction.

In conclusion, the dissertation resolves a gap between central theories of the policy process, specifically PE and DIP, and cases of gradual change which were not specifically accounted for by these theories. The dissertation shows that gradual changes are common and central to policymaking though in the long-term they occur in a unidirectional PE pattern. Within an elaborate version of DIP, the dissertation suggests, that various configurations of intensity of signals and institutional friction, generate four differing policy patterns. These patterns add up to a general PE pattern of change. Nevertheless, periods of more proportional, gradual and accumulating change may emerge under specific conditions detailed in the study. In addition, the study has significant implications for how we understand small changes. Small changes are by far the more common and cannot be treated as simply insignificant changes, as a significant amount of small changes may very well be part of trending series of changes. Hence, when analyzing the government's seemingly routine outputs, we should be sensitive to patterns of gradual change.

Letter of Contribution

For all three articles, Ehud Segal developed the initial theoretical notions, reviewed and analyzed the literature, developed the theoretical concepts, conducted the empirical work, conducted the data analysis and wrote the articles. Contributions by other researchers, apart from Professor Feitelson's dissertation supervision, are detailed below for each article separately.

Chapter 1. When Small Policy Changes Accumulate: Policy Sequences in Air Pollution Policy in Israel

This chapter was written solely by Ehud Segal.

Chapter 2. Punctuations and Trends in Budgetary Change

Professor Frank Baumgartner helped clarify and develop the concepts, carried out parts of the data analysis, and significantly contributed to the writing process.

Chapter 3. Patterns of Policy Change as Interplay Between Signals and Friction: A Comparative Case Study of Road Safety and Air Pollution Policies in Israel

Jessica Genauer performed some of the literature review and analysis, helped clarify the theoretical concepts and significantly contributed to the writing process.

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Introduction

'Nothing has really changed' is an often-heard complaint in the policy arena, as is 'things are not as they used to be'. So what is the truth? Change and stagnation[1] are a central subject in policy studies since its formation. Does change occur? How can we explain change? Are there general patterns of change? These are central questions dealt with by theories of the policy process (for a review of policy process theories see: Sabatier and Weible 2014).

An early and widely acknowledged theory of policy change was Charles Lindblom's incrementalism, a behavioral theory of how decision makers form policy. Lindblom's central argument was that rationally bounded decision makers (Simon, 1957) in governments need to cope with complex policy issues set in nuanced political and organizational environments. Therefore, decision makers are bound to choose a step-by-step approach to changing policy in order to reduce risks of error and failure and to increase the likelihood of achieving acceptable change. Incrementalism remains a cornerstone of policy change literature to this day (Howlett and Migone, 2011). However, approximately three decades after its publication, several scholars produced theories that detail factors and conditions enabling sharp changes in policy (for a comparative analysis of policy process theories see Schlager 2007). Multiple streams (MS) (Kingdon [1984] 1995), advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith 1993), and punctuated equilibrium (PE) theory (Baumgartner and Jones [1993] 2009) present strong evidence that substantial policy changes tend to be brief and abrupt. This general approach replaced incrementalism as the prominent approach to the policy process.

MS, ACF and PE actually contain incrementalism in the sense that they add the possibility of major changes to the usual incremental-change state of affairs (Jones and Baumgartner, 2005). However, in the process of theoretical evolution, Lindblom's original conception of incrementalism was seen as an over-simplified "*political pattern"* in which policy change only occurs at the margins" (John and Margetts 2003, 413). In contrast, Lindblom understood incrementalism as "*political change by small steps*" (1979, 517), steps that are not limited to insignificant changes as "*a fast-moving sequence of small changes can more speedily accomplish a drastic alteration of the status quo than can an only infrequent major policy-*

[1] The tension between change and stagnation is present in the Hebrew word for change, "SHINUY", which shares the same root as the verb *to repeat* – "SHANA. Ecclesiastes describes this paradox by stating that *"there is nothing new under the sun*" (1:9), yet "*To everything there is a season, and a time to every purpose under the heaven*" (3:1)

change" (Lindblom 1979, 520). While the possibility of gradual and significant change wasn't included in the theories focusing on major changes mentioned above, several studies presented cases of gradual policy change, in various policy fields and in different countries, including: forestry policy in Canada (Cashore and Howlett 2006; 2007), agriculture policy in various countries (Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Skogstad 1998), administration reform in Italy (Capano 2003), financial sector policy in the UK (Kay 2011), pharmaceuticals policy in Spain (Chaqués and Palau 2009), public pensions in Western industrialized countries (Weaver, 2010), and policy towards indigenous peoples in Canada (Howlett 1994).

The gap between the explanatory focus of PE, ACF and MS and the possibility of gradual and significant policy change, as demonstrated by the above-mentioned case studies, is the focus of this dissertation and of its three articles in this article-based format. PE theory contends that the basic pattern of policy change is a general state of policy equilibrium, punctuated by short bursts of intense change, which occur under exceptional conditions (Baumgartner and Jones [1993] 2009). Large data sets of annual budget changes in several Western countries, at both national and local levels, provided substantial evidence for a general PE pattern in policymaking in these countries (Jones and Baumgartner 2005; Jones et. al. 2009). Disproportionate information processing theory (DIP) (Jones and Baumgartner 2005) provides a behavioral account for PE theory and was introduced as a counterpart to Lindblom's behavioral explanation for incremental policymaking (1959; 1979). DIP's underlying rationale is that decision makers typically suffer from a constant overload of information and signals concerning policy issues. Thus, most issues receive too little attention. Occasionally, signals concerning a new critical issue or a previously neglected critical attribute of an issue rise sharply and in turn are "discovered" by policy makers. In such cases, policy makers allocate high levels of attention and the magnitude of the potentially ensuing change increases accordingly. Hence, disproportionate information processing on behalf of decision makers results in both under-reactions and over-reactions to signals. These are seen in disproportionately sized policy outputs in comparison to the expected normal distribution of outputs; in accordance with the central limit theorem given that policy signals originate from many sources (Jones and Baumgartner 2005). Such a disproportionate distribution of changes would have more small changes than expected (high central peak), less medium changes than expected (missing shoulders) and more very large

changes than expected (fat tails). Disproportionate information processing is further amplified by institutional friction that adds a signal threshold to government agencies' policy reactions.

The first article titled "When small policy changes accumulate: policy sequences in air pollution policy in Israel", is a high-resolution study of gradual change. The article introduces the concept of policy sequences, defined as series of small changes that accumulate to more significant change over time. The study strives to improve our understanding of gradual policy by focusing on the following questions: (a) how does accumulation of change over time occur?; (b) what differentiates non-major changes that accumulate over time from those that do not?; and (c) how can DIP be refined or expanded to account for gradual change? Air pollution policy in Israel was examined as a demonstrative case of gradual and accumulating change over time. A methodology incorporating a change-by-change analysis for assessing accumulation over time was developed and applied. The findings demonstrate a clear policy sequence pattern in the subcase of vehicle air pollution policy, but not in the subcase of industrial air pollution policy. With regard to DIP, the case study demonstrates that when signals are continuously pointing towards a certain direction of change and institutional friction is not too high, a policy sequence may be generated by the relevant government bodies.

Shifting from micro-scale to macro-scale, the second article examines gradual change in the United States' federal budget over the period of 1947 through 2014, with 60 categories of spending consistently defined over time.. The article is coauthored with Frank Baumgartner and is titled "Trending series in budgets". The article focuses on fundamental questions concerning gradual and accumulating changes: (a) how common are they?; and (b) do trending changes, that accumulate into more significant change over time, evolve in a more proportional pattern of change in comparison to PE patterns, that have been found to characterise budget changes in Western democracies (Jones et. al. 2009). Results show that most changes in budgets are part of trending series of four years. Congruently, trending series of budget changes are central to the logic of budget making. They also show that PE theory holds for trending series even though change is directional. In DIP's terns this means that decision makers generate disproportional patterns of change even if change is progressing and accumulating in a certain direction.

The third article, prepared with Jessica Genauer, titled "Patterns of policy change as interplay between signals and friction: a comparative case study of road safety and air pollution policies in Israel", examines patterns of policy change in three longitudinal case studies in Israel

over approximately fifty years: road safety policy, vehicle air pollution policy, and industrial air pollution policy. It has two general aims: (a) to test findings from the second article, concerning trending PE patterns, outside of the budget policy domain; and (b) to continue developing DIP theory to account for gradual changes. Specifically, the study examines the way in which the interplay of signal strength and levels of institutional friction affect policy change patterns for issues that move in a consistent policy direction over long periods of time. The study employs a mixed methods approach. Findings show that variance in signal strength and institutional friction result in several basic policy change patterns: slow incremental change; gridlock; and punctuated patterns of change. In addition, they also show that there is a certain gap between signal strength and institutional friction level at which a gradual, relatively proportional pattern of accumulating policy change is likely to occur.

The three scales of study in the three articles required developing and applying designated methodologies: change-by-change policy content analysis for the high-resolution study; an algorithm that identifies trends in budgets for the macro-scale study; and a longitudinal analysis of policy change for the meso-level study. This diversity in the scale of inquiry produced a unified finding that gradual directional change exists at all levels of policymaking. In addition, findings from one scale were subsequently examined in other scales, for example: sequencing found at the high-resolution analysis led to the identification of trending series in budgets at the macro scale; in turn, this led to a longitudinal study of internal patterns of change at the meso level.

Overall, the three-step journey, from micro to macro and back to the meso, presents a cohesive study of patterns of policy change. The three articles build on one another to provide new insight into how gradual accumulating policy change and large, infrequent policy change can be integrated into a comprehensive understanding of policy change patterns. An overview and discussion of limitations of the study appears in the conclusions.

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I. When Small Policy Changes Accumulate: Policy Sequences in Air Pollution Policy in Israel

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Unpublished
To be submitted to the Journal of Comparative Policy Analysis: Research and Practice

Abstract

The literature on policy change presents a contradiction. On the one hand, there is strong evidence for punctuated equilibrium (PE) patterns and disproportionate policymaking, while on the other hand a sizeable body of literature describes gradual change and more proportional policymaking. I explore this inconsistency by analyzing characteristics of policy changes and the relations between them at a change-by-change resolution. Disproportional information processing theory (DIP) (Jones and Baumgartner 2005a; 2005b) is used as the theoretical framework for this study. The case examined is air pollution policy in Israel over a three-year period (2002–2004). I constructed a timeline of 37 policy changes based on 193 newspaper articles concerning air pollution policy in the country. Policy changes were grouped into three distinct series, relating to different sub-issues of air pollution policy. Several methods for assessing significance of accumulation over time were developed and applied. Results show that: (a) there is a mode of policy change of small changes that accumulate to more significant change over time which I term as a policy sequence; (b) differentiating between changes that are part of policy sequences and those that are not requires an analysis of policy content. To that end a friction-oriented vs. change-in-standards policy-content analysis proved to be useful.In addition, the case suggests that when signals are continuously pointing towards a certain direction of change and institutional friction is not too high, a policy sequence may be generated by the relevant government bodies. Based on these findings, I suggest refining DIP theory accordingly.

Keywords: policy process; policy change; air pollution; policy sequences; gradual change; punctuated equilibrium; disproportionate information processing theory.

Introduction

Theories and studies explaining policy change present a contradiction. On the one hand, theories of the policy process, such as multiple streams (MS) (Kingdon [1984] 1995), advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith 1993), and punctuated equilibrium (PE) theory (Baumgartner and Jones 1993) present strong evidence that substantial policy changes tend to be brief and abrupt. On the other hand, several studies explicitly describe cases of gradually accumulating changes in policy (Capano 2003; Cashore and Howlett 2006; 2007; Coleman Skogstad and, Atkinson 1996; Daugbjerg 1997; Howlett 1994; 2003; Skogstad 1998).Several additional strands of political research, such as the historical institutionalist approach (Hacker 2004; Mahoney and Thelen 2010; Pierson 2004; Thelen 2004) and research on policy responsiveness (for a review of the literature see Burstein 2003), also describe processes of gradual policy change.

In this article, I examine this inconsistency in the literature by analyzing the characteristics of policy changes at a high resolution with the following questions in mind: (a) Are there non-major policy changes that add up to larger changes over time?; (b) How can one differentiate these changes from policy changes that do not accumulate to greater change over time?; (c) What are the general conditions under which we would expect such changes to accumulate?

The first two questions are typological. In the aforementioned policy process theories policy outputs are understood to be either slight adjustments/incremental changes (Lindblom, 1979) occurring in a general state of gridlock, or alternatively, they may be major/punctuating changes (Howlett and Ramesh 2002; Cashore and Howlett 2007). This typology has been criticized as "*rather blunt*" (Howlett and Cashore 2009, 36). This study suggests a third policy change type: policy changes that are part of policy sequences, that is, a series of small to moderate policy changes that accumulate to more significant change over time. In the case studies demonstrating gradual change mentioned above, gradual change is identified but not analyzed and measured at a high resolution. In this study I analyze policy changes at a change-by-change resolution. This enables sharper identification and analysis of accumulation over time. The high-resolution analysis also allows for differentiation between changes that are part of significantly accumulating policy change processes and those which are not. Hence, it serves as a basis for generalizing the differences between the two types of non-major policy change.

The third question is theoretical, and addresses the dearth of theoretical explanation for how gradual change takes place. Currently, MS, ACF and PE theory focus on factors that lead to major policy changes (Schlager 2007, 309–10) in an otherwise stable policy equilibrium, and do not account for gradual accumulating changes. However, as indicated by large data sets of annual budgetary changes, most policy changes in developed countries are small changes (Baumgartner et al. 2009; Jones et al. 2009). If a significant share of these changes is composed of policy changes that are part of sequences, then adaption and refinement of current theories of the policy process may be required. Breunig and Koski's (2012) study supports the possibility of non-major changes accumulating to substantial change as they find a positive relationship between low degrees of punctuation in budget categories and long-term accumulated growth.

The general theoretical framework used is PE theory and specifically disproportional information processing theory (DIP) (Jones and Baumgartner 2005a; 2005b). This theory explains how disproportional information processing on behalf of decision makers, i.e., most information concerning policy issues does not receive enough attention whilst only information concerning a small number of issues receives large amounts of attention, causes a PE pattern of policymaking. DIP employs a "signal-response" rationale that was incorporated into the study's methodology – both signals and responses were measured.

The study examines air pollution policy in Israel at a high resolution from 2002-4. Policy in this field had progressed gradually, mainly since the 1990s, and therefore is suitable for the examination. From the 1980s as the issue's salience gradually rose and environmental NGO activity expanded (Orenstein and Silverman 2012), air pollution policy and regulation significantly progressed, without any evident punctuations. Even a national air pollution act, passed in 2008 , did not punctuate existing policy, but rather strengthened the existing trend, while providing policy makers with a more structured legal framework for advancing change.

The paper begins with a review of the gradual change literature and DIP theory, proposing the possibility of policy sequences. Next, the methodology is outlined. Then the results section presents the analysis of three series of policy changes in different sub-issues of air pollution policy, some of which were found to occur in policy sequences. Finally, I discuss the results including the typological findings, the suggested refinements to DIP theory, and some consequences for our understanding of the policy process.

Punctuated Change and Gradual Change

The literature on policy change presents a contradiction between theories of the policy process as one of punctuated equilibrium, such as MS, ACF and PE, and case studies that present policy change as a process of gradual, accumulating change. MS, ACF and PE specify certain factors and conditions that allow rare major changes to occur in an otherwise stable policy equilibrium (Schlager 2007, 309–10). In MS, the rare window of opportunity opens when a policy entrepreneur takes advantage of a rising problem, a related solution and considerable political interest (Kingdon [1984] 1995). In ACF, an external or internal shock is required in order to upset a policy subsystem's stability (Sabatier and Jenkins smith, 1989). According to PE theory, major change may occur when an issue's image radically changes and political groups promote change through new political venues, thus destroying the reigning "policy monopoly" (Baumgartner and Jones]1993] 2009). If these conditions are not fulfilled, then "*policy change only occurs at the margins*" (John and Margetts 2003, 413) and equilibrium endures, (Bendor 1995), also termed gridlock (Jones, True, and Baumgartner 1997).

In contrast, several case studies describe gradual, accumulating policy change that does not fit neatly into a punctuated equilibrium dynamic of change. For example, Cashore and Howlett (2006; 2007) argue that in US Pacific Northwest forest policy, existing institutions prompted paradigmatic changes in logging practices "thermostatically" in order to protect endangered species. Skogstad (1998) finds that the European state assisted agricultural paradigm in the early 1990s was gradually adjusted and augmented with new goals. This process increased the sector's economic endurance in comparison to the United States' relatively stagnant agricultural policy. Also with regard to agricultural policy during this period, Coleman, Skogstad, and Atkinson (1996) claim that cumulative incremental changes in policy settings and instruments gradually led to paradigmatic change in the EU, Canada and Australia. Daugbjerg (2003) also identifies this pattern in the EU and defines it as a case of moderate change (Daugbjerg 1997). Capano (2003) identifies similar patterns in Italian administrative reform and Howlett (1994) describes a sixty-year process in which the governing paradigm of Canadian policy towards aboriginal people shifted dramatically.

In line with these cases, Lindblom's incrementalism (1959, 1979) is actually not restricted to equilibrium or gridlock. Lindblom defines incrementalism as "*political change by small steps*" (1979, 517); this does not preclude the possibility of changes, even if small, in the

core aspects of an issue. Nor does it preclude the possibility of accumulation into larger changes. Lindblom suggests that "*A fast-moving sequence of small changes can more speedily accomplish a drastic alteration of the status quo than can an only infrequent major policy-change*." (1979, 520). Similarly, Wildavsky describes rapidly rising entitlements, such as Medicare, which rose from $37.8 billion to $66.7 billion over a decade (in constant FY86 dollars) (1988, 310).

Other scholars also point to the possibility of gradual accumulating change. Durant and Diehl (1989) suggest the possibility of significant accumulation of policy changes. Using a two-by-two taxonomy of agenda procedures, they examine tempo (rapid or protracted) and expected size (incremental or paradigmatic). Howlett and Ramesh (1998) adapt this taxonomy to the policy change variable, pointing to four types of change patterns: rapid paradigmatic, gradual paradigmatic, rapid incremental, and gradual incremental. Also in support of gradual changes is Thelan and Mahoney (2010) theory of gradual institutional change. They demonstrated that significant institutional change occurs in a gradual manner, over decades in different countries and in various policy fields.

Research on policy responsiveness also describes a policymaking dynamic that has the capacity to generate gradual changes. A sizeable body of literature argues that government policy is responsive to public opinion (for a review of the literature on this topic see Burstein 2003). Not only does public opinion inform who governs democratic societies, but it also determines the behavior of political and bureaucratic officials between elections (Stimson et al. 1995). Policy responsiveness is often described as a continuous process of back and forth (Wlezien 1995). Specifically, Wlezien (ibid) describes the process of policy responsiveness as a thermostat: When policies are out of line with public opinion, politicians “turn” policy to the temperature that they perceive the public to prefer. The public, in turn, turns down the “opinion temperature” to signal that no further change is necessary. Jennings (2009) develops this theory further. Using an error-correction model to represent the interactions between public opinion and responsiveness, he shows the sustained, long-term, positive relationship between policy and public opinion. Hence, the literature on responsiveness allows for governments to react in a gradual, accumulating manner as long as public opinion has a stable inclination in a certain direction.

The apparent contradiction between punctuated equilibrium theories of policy change and studies demonstrating gradual change suggests that a reexamination of acknowledged policy

process theories, such as MS, ACF, PE and DIP, is needed. In this article I focus on reexamining DIP and refining the theory to explain cases of significant gradual change as described in the following section. The literature that does describe cases of gradual policy change does not include a change-by-change analysis of policy changes. I employ a high-resolution analysis of policy changes as detailed in the methodology section. The analysis serves as a basis for measuring accumulation and for comparing accumulation in different policy sequences, as well as for differentiating between non-major changes that are inconsequential and those that are part of change sequences that accumulate to significant change over time.

Developing DIP to Account for Policy Sequences

DIP (Jones and Baumgartner 2005a; 2005b), PE theory's behavioral account, is the theoretical framework used in this study for examining and developing the concept of policy sequences. It is based on a "signal-response" rationale. As an alternative to Lindblom's behavioral explanation for incremental policymaking (1959; 1979), DIP explains PE policy-making patterns from a behavioral perspective. Its theoretical rationale assumes that decision makers suffer from a constant overload of information and signals concerning policy issues. Thus, most issues receive too little attention. However, occasionally, a new critical issue or a previously neglected critical attribute of an issue is "discovered" and receives high levels of attention. This shifts the magnitude of policy change accordingly. Hence, decision makers' disproportionate information processing results in both under-reactions and over-reactions to signals, which creates disproportionately-sized policy outputs (Jones and Baumgartner 2005a; 2005b). Additionally, institutional friction amplifies the disproportional response by adding a threshold to government agencies' reactions to signals from their environments. In addition, when an issue is "discovered," reinforcing political "bandwagon" effects may amplify change (ibid).

Institutional friction is a main element that restrains policy change, increasing the disproportionality of policy change patterns (Jones and Baumgartner, 2005a). Institutional friction is composed of four main types of costs: decision costs, transaction costs, information costs, and cognitive costs (ibid). Decision costs are the costs associated with reaching agreement about policy change, this includes bargaining costs and institutionally-imposed costs in the decision-making process. Transaction costs are the costs involved in implementing a policy decision, once agreement has been reached. Information costs are the costs of obtaining

information regarding the relevant policy change. Finally, cognitive costs, are the costs associated with the limited capacity of human agents within an institution to be cognizant of all policy issues requiring change. In the study we use typology of the four costs to differentiate between policy changes which progress policy and those which deal with friction.

Extensive empirical findings demonstrate a typical PE pattern of policy changes in governmental policy-making as theorized in DIP. For instance, Jones and Baumgartner (2005b) examine US federal yearly budgetary percent changes in about 60 subtopics of government spending, between 1948 and 2003. The distribution of annual budgetary percent changes in these subtopics has a high kurtosis, displaying a central peak of small changes, missing shoulders of medium changes, and fat tails of relatively large changes. Similar distributions of budgetary changes are also found in other developed countries (Baumgartner et al. 2009; Jones et al. 2009). Thus, a general empirical law of public budgets maintains that budget changes in Western democracies follow power function probability distributions, displaying "*periods of quiescence interrupted by bursts of frenetic activity*" (ibid, 870).

In its current form, DIP does not explain gradual change dynamics. Specifically, I propose *policy sequences* – series of small to moderate policy changes in a certain direction that accumulate into more significant change over time – as an additional policymaking mode. Refining DIP to account for policy sequences requires consideration of the interplay between the two central factors that may affect policy change patterns: signals and institutional friction. This is assuming that the disproportionate attention dynamic is uniform and persistent. Studies of policy responsiveness point at the conditions under which policy sequences may be formed. According to the thermostatic model (Jennings 2009; Wlezien 1995), if signals are constantly pointing towards a certain direction of desired change, then a gradual response may occur in the form of a policy sequence. With regard to institutional friction, it will likely limit the scope of change. However, if friction is not too high, small and mid-size changes are likely to be generated. Hence, persistent signals and moderate or lower levels of institutional friction should allow for policy sequences within DIP's framework.

Methodology

Air pollution policy in Israel was examined as it presents an appropriate case to examine gradual policy change. Since the 1990s, the issue of air pollution has gradually risen on Israel's national

agenda. Concurrently, during this period, policy significantly evolved as Israel gradually adopted more stringent environmental standards, reducing the gap with standards used in developed countries . This occurred without any evident punctuations in policy. Even a national air pollution act (the Israel Clean Air Law), passed in 2008, did not "punctuate" existing policy. Rather, it strengthened the existing trend of change by providing policy makers with a more structured legal framework. The gradual progress in air pollution policy during this period offers an opportunity for studying patterns of accumulation and policy sequences.

The study employs a mixed methods high-resolution analysis to investigate gradual change by analyzing policy sequences at a detailed, change-by-change resolution (on the importance of focusing on meso-level processes see Elster 1989, Sharpf 1997, 30). The parameters of the research required limiting the period of time analyzed to three years. The change-by-change resolution provided a detailed depiction of the various non-major policy changes that were generated by the government. The high resolution also allowed for an examination of how policy changes accumulated, and for comparing between patterns of change accumulation in different policy sequences.

The analysis covers policy changes from 2002 to 2004. These temporal boundaries were chosen for two reasons: One, the newspaper article database used was only available from mid-2001. Two, 2004 was chosen as the endpoint because shortly afterwards efforts of members of the Knesset (the Israeli parliament), government officials, and non-government organizations (NGOs) promoting the Clean Air Act began to accelerate. Although policy continued to gradually progress, expectations of a major change resulting from the pending legislation may have influenced the dynamic of policy change.

The methodology reflects DIP theory's focus on policy signals as inputs to the decision-making process, and policy changes, the outputs of the process. A qualitative assessment of friction was also added in order to examine its effect on the policy change patterns formed and the generation of policy sequences.

Issue saliency, an indicator of signal strength, was measured by the annual number of newspaper articles that contained the term air pollution in Israel's most popular newspaper, Yedioth Ahronot. 26 years were sampled and coded in 4-year increments from 1980 to 2006 in order to identify the general trend of signals preceding the years analyzed. (The data is available in Appendix III.) As the size of a newspaper, in terms of the average number of articles in a

single issue, may change over the years, I sampled its size and used the results for normalizing annual article counts of air pollution related articles. The total number of articles, annually, in all topics was determined by sampling the total number of articles in two days each year, averaging them, and multiplying by 6 days (Israeli papers are published six days a week) and 52 weeks. The days used were the first Tuesday of November and the first Wednesday of August as both are periods without any Jewish festivals, which may affect the newspaper's format.

To validate that air pollution saliency was an indicator of air pollution as a problem issue, rather than an indicator of an improvement in air quality, I sampled the articles and counted the number of articles describing air pollution in a positive context such as an improvement or satisfactory condition. A sample of six years, in 5-year intervals, from 1980-2005 of articles containing the search term and in which the air pollution issue was the central topic, showed that only 2% of the articles described a satisfactory condition. The data breakdown is available in Appendix II.

The construction of a policy change timeline was based on data concerning air pollution from Haaretz's article database. This daily newspaper is known for its coverage of environmental issues. I chose to use this source over government reports and documents as the latter are scarce and often unavailable in Israel. Moreover, newspaper coverage provides a broad account of events, which proved to be helpful for constructing a policy change timeline and for understanding its context. It should be noted that newspaper coverage usually does not cover small adjustments in policy as such changes do not cross the threshold of public interest. This did not undermine the study's ability to identify and describe patterns of accumulation over time, as policy changes need to have some significance in order to accumulate into larger change.

Pollution was used as the basic search phrase in the Haartez article database for the three years studied. Additionally, when high salience events took place, such as a fire in a refinery, a parallel search with a search phrase referring to the event was performed for the relevant period. Articles on high salience events may assume the reader is aware of the context, such that key words like pollution may not appear. Thus, the additional search was performed in order to obtain more articles on the event and the governmental response. Approximately 2000 search results were surveyed (about 60 results per month). Of these, 246 concerned air pollution. These articles were fully read and coded by title, date and the sub-issues of air pollution policy to which they related. Of these, 193 articles concerned air pollution in Israel, averaging more than 1.2

articles per week. This coverage intensity gave a suitable critical mass of material to work with, considering the small size of the country. Of the 193 articles concerning air pollution in Israel, 98 had concrete information on policy changes with national significance. Of these, 37 policy changes for the relevant period were identified (the policy change data is available in Appendix I). Each policy change was coded for date of occurrence (which had to be estimated for some of the policy changes), description of the policy change, the policy change's related sub-issue (for example, industrial air pollution), policy change type (change in: regulation, enforcement intensity, organizational characteristics, monitoring and research), the policy change producer, other organizations involved, estimated size (using three indicators), direction (more or less environmentally friendly) and whether the policy change was a direct reaction to a triggering event. For the construction of the policy change timelines the policy changes were grouped into series by their related sub-issues.

Measuring policy change required considering several aspects. First, how are policy changes defined? Several studies point to a general lack of consensus (Pierson 2001; Green-Pederson 2004; Howlett and Cashore 2009) over the definition, operationalization and measurement of policy change. In this study, only changes with some sort of formal manifestation were included, thus excluding mere declarations and statements. These changes were termed 'actual policy decisions,' as they include a formal act. Examples include: changes in regulation, changes in enforcement intensity, a formal approval of a plan or policy, and a formal establishment of a committee. This differs from ACF's focus on changes in the *dominant coalition's beliefs* and from MS's and PE's focus on the decisional agenda (Real-Dato, 2009). However, it parallels the focus on the intensity of policy outputs apparent in MS and PE, and DIP

Second, how does one measure policy change significance? To this end, three indicators were employed (the policy change data is available in Appendix I). First, I differentiated between policy changes that directly improved emission standards or promoted cleaner technologies and policy changes which were related to institutional friction costs. The latter type included policy changes related to decision making costs such as the establishment of committees; policy changes related to transaction costs such as strengthening enforcement; and policy changes related to information costs such as conducting research. Second, since the 1990s, Israel has been gradually shifting from emission standards of developing countries to those of developed

countries. Specifically, Israel has modeled regulation on EU standards and Germany's national instructions for air quality control. Hence, changes in gaps between Israeli standards and standards in developed countries were also an indicator of a significant change in policy. Therefore, policy changes that raised emission standards to those used in developed EU countries were also singled out. As a third indicator and attempt to depict change quantitatively, a size indicator value (SIV) assessment method was developed and applied. The method was based on four sub-indicators, three of which were drawn from Baumgartner and Jones' (1993) description of the general characteristics of policy punctuations. According to the authors, punctuations include changes in agency, budget, and law/regulation. A fourth sub-indicator was added to reflect the direct effects of the policy change on air pollution levels. Each sub-indicator was given three possible grades: insignificant, moderate and major. For each policy change, an SIV was assigned in the following manner: each policy change had an initial value of one point; each moderate sub-indicator associated with the policy change added two points to the SIV; and each major sub-indicator associated with the policy change added six points (see descriptions of the moderate and major indicators in Table 1). The threefold value of major indicators reflects the gap between non-major changes and major changes that is apparent in distributions of budgetary changes discussed above. The specific indicators associated with each policy change were qualitatively assigned and are explained in the policy change database (see note ii for the internet address).

Third, the issue of policy change direction had to be addressed. In order to affirm accumulation, direction of change must be asserted (Howlett and Cashore 2009). This is not always simple to determine. However, in the case of air pollution policy, determining whether a policy change was more or less environmentally friendly did not present any complications.

After policy changes were divided into policy series in accordance to their related sub-issues, the following characteristics were analyzed: *Flow*: successive – a relatively constant rate of policy changes was generated, or spasmodic – periods of almost no change contrasted with bursts of change, often triggered by external events. *Accumulation of change*: analyzed using the three indicators described above. *Basis of policy change generation*: wide – policy changes were generated by several different governmental ministries/agencies; or narrow – policy changes were mainly generated by a single governmental ministry/agency. *Sequencing*: In order for a

series to be identified as a policy sequence it needed to show both significant accumulation of change and successive flow.

Table 1. The Four Indicators Used to Determine a Policy Change's SIV

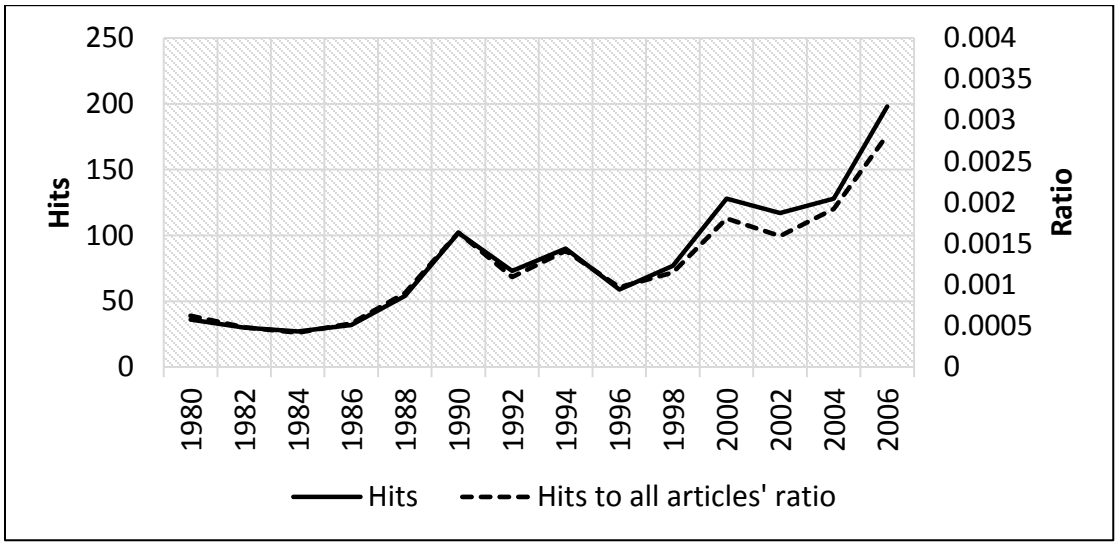
	Δ Agency	**Δ Budget**	**Δ Regulation/law**	**Effect on problem**
Indicators of major change (six SIV points)	New agency, agency overhaul, or new major inter-agency collaboration	Large change in budget	New law, law overhaul, or new major regulation	Significant potential for a dramatic effect on problem or an immediate moderate effect
Indicators of moderate change (two SIV points)	Moderate agency expansion/contraction; or a new inter-agency collaboration	Moderate change in budget	Moderate change in law or regulations	Potential for moderate effect on problem or a small immediate effect

Results

Issue Saliency

Air pollution's saliency, as indicated by the number of articles mentioning the term air pollution in Israel's largest daily newspaper, Yediot Aharonot, rose steadily over the time period studied (see Figure 1) doubling in numbers each decade: from 30-54 articles including the term air pollution per year in the 1980s, to 59-102 in the 1990s, and 117–198 from 2000-2006. These data confirm that the saliency of air pollution as a public issue steadily rose over the last three decades. The normalized measurement displayed an almost identical pattern. This rise is also evident in the expansion of the environmental NGO sector from just a few organizations in the 80s; to a few dozen NGOs with unique, often site-specific, agendas in the 1990s (Tal 2002; Schwartz 2009); and to more than a hundred distinct organizations in the first decade of the 21st century.

Figure 1. Issue Saliency Indication



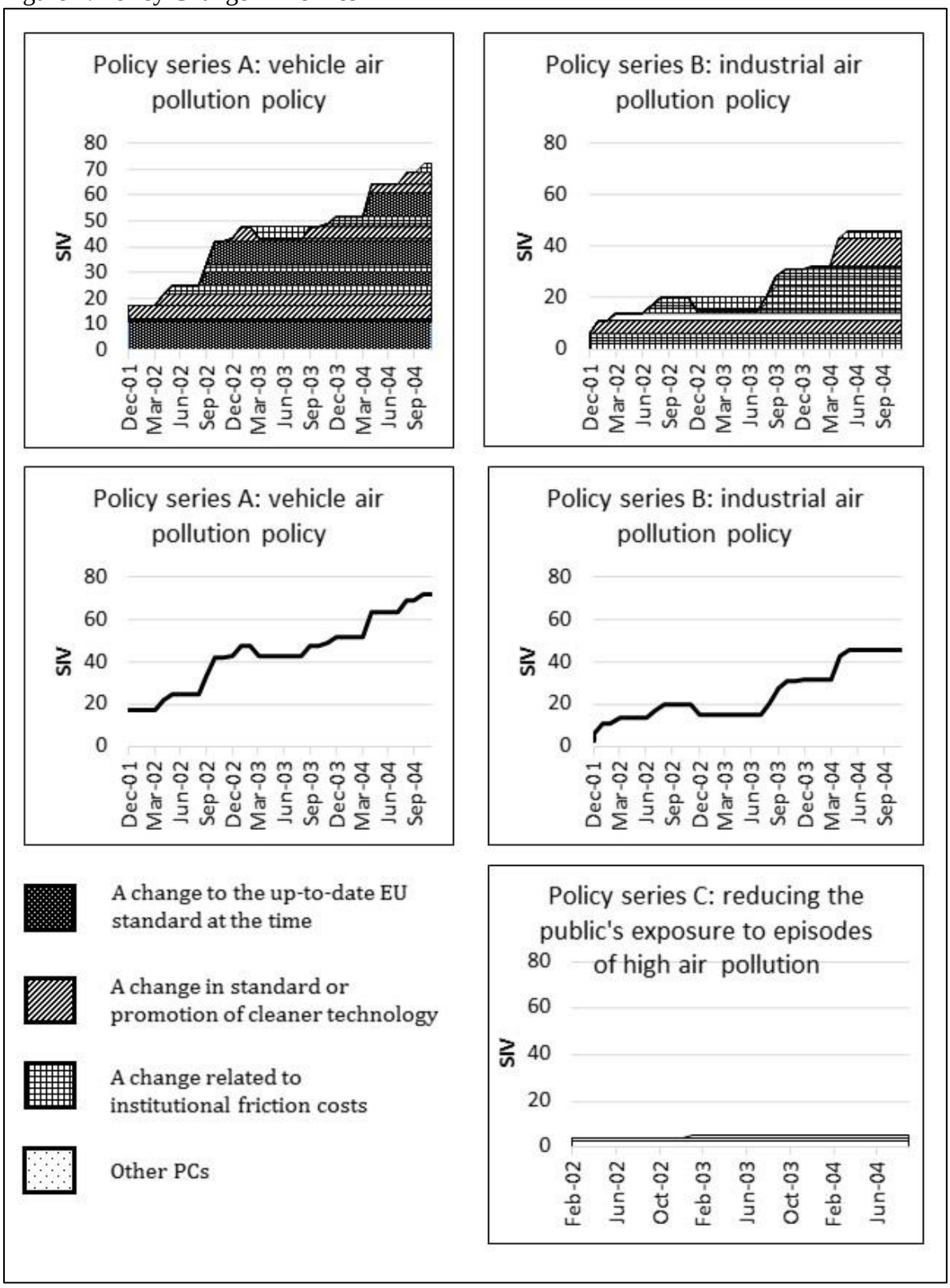
Analysis of Sequences

The policy changes coded were found to be related to three distinct sub-issues: series A – mitigating vehicle air pollution; series B – mitigating air pollution from industrial factories and plants; and series C – reducing the public's exposure to episodes of high air pollution levels. The policy changes, their descriptions and the assigned indictors of size are detailed in Appendix I. Figure 2 shows a graphic representation of each series with the policy changes stacked. Accumulation of change, as indicated by the SIV value of each policy change, is represented by the height of the graph. The graph software overlays negative policy changes on positive ones. Therefore, in series A and B, which have policy changes with negative values, a line graph is also provided.

Policy Series A: Vehicle Air Pollution Policy

This series has 18 policy changes, 15 of which occurred throughout 2002–2004 and three policy changes that occurred in late 2001 and were reported upon in early 2002 (the full policy change data is presented in Appendix I). The series is successive, for the most part, with a relatively high rate of policy changes per year. Overall, the series displays impressive accumulation: a significantly cleaner diesel fuel was gradually introduced to the diesel vehicle sector, immediately decreasing emissions and allowing for advanced emission control technologies, which could further reduce pollution. At the same time, enforcement of penalties for

Figure 2. Policy Change Timelines[2]



[2] Policy changes which occurred in late 2001 and were reported upon in 2002 were stacked in 1/2002.

noncompliance to the clean diesel policy was carried out. In addition, the up-to-date EU standard for vehicles was adopted, in voluntary compliance with the EU directive. Also a significant tax reduction, lowering retail prices by 30%, on environmentally friendly hybrid vehicles was enacted. Lastly, LGVs were enabled on the road, as was common in many developed countries at the time, providing a cleaner alternative to gasoline vehicles.

In total, 12 policy changes that changed emission standards or promoted cleaner technologies were put in place, out of which four policy changes were consistent with EU standard. Only six policy changes were related to institutional friction costs. The total SIV reached was 72, indicating a significant accumulation of policy changes mitigating the air pollution impacts of vehicles. The series has a wide base of policy change drivers, as changes were initiated by the MEP as well as the governmental bodies responsible for setting fuel standards and regulating car imports. Notably, the LGV policy changes have a wide base of agencies generating policy change including the Ministry of Infrastructure, the Finance Ministry, a dominant inter-ministerial committee, and the National Council for Planning and Building. Overall, the series meets the requirements of a policy sequence, as a successive flow of policy changes accumulating into significant change by introducing policy changes that aim to reduce, in various complementary ways, the total air pollution emissions per kilometer of vehicles in the country.

Policy Series B: Industrial Air Pollution Policy

This series consists of 16 policy changes, which occurred between 12/2001 and 12/2004, most of them were generated by the MEP. Several policy changes concerned the Ramat Hovav Industrial Area (RHIA), an industrial zone for hazardous industries and waste. A planned relocation of large Israeli Defense Force bases to the vicinity of this area and constant complaints of odors disturbing residents in the nearby city of Beersheba raised concerns about air pollution levels and related health risks. The series includes both successive and spasmodic components. Policy changes in 2002 display a successive flow, as a chain of ongoing efforts, including surprise inspections of emissions in factories, led to several criminal investigations of executives in cases of excessive emissions. In contrast, in 2003–2004, the series is more spasmodic, as most policy changes were reactions to visible polluting incidences in factories. However, there were only two changes in standards. The most notable is the 2004 change in business license requirements for

industrial plants at the RHIA. The new instructions required plants to treat their toxic waste instead of piping it to what the MEP considered a problematic toxic waste treatment plant in the zone.

In contrast to the vehicle sequence 13 policy changes were related to institutional friction costs mainly of the transaction type, i.e. costs involved in implementing a policy decision, and only two changed pollution standards. In addition, there weren't any policy changes adopting EU standards at the time. The SIV indicator still accumulated to 45, as it included the policy changes that were generated to deal with the polluting incidences in factories, as well as other changes in enforcement intensity. Overall, throughout this series, it seems the MEP was more occupied with managing the enforcement of existing standards than in updating standards. The closure of the electrochemical plant in the Haifa Bay Area (HBA) should be noted as a relatively strong act of enforcement. The base of policy change generation in this series is quite narrow, as the MEP generated most changes.

As a whole, the policy series does not display a distinct policy sequence pattern, as accumulation is weak and many policy changes were actually triggered by specific incidences and dealt with aspects of institutional friction. However, if policies towards RHIA are analyzed separately, they do display a policy sequence pattern. Of the six policy changes concerning pollution from the RHIA, one included a change in standards and all were initiated with no direct connection to specific pollution incidences. Policy changes regarding the RHIA are also sequential: surprise checks were followed by fines and hearings, more surprise checks, and, finally, changes in factories' emissions permits. In contrast, in the case of the five HBA policy changes, none pertained to emission standards and all but one were triggered by pollution incidences. The difference is also apparent in the accumulated SIV, which is 23 for the RHIA factories and 11 for the HBA factories.

Policy Series C: Reducing the Public's Exposure to Episodes of High Pollution

This series has only three policy changes of small significance, all generated by the MEP's National Air Quality Monitoring Unit. During 2001, the MEP decided to provide air pollution forecasts, first in the Tel Aviv metropolitan area and then in other populated areas across the country. In February 2002, the Ministry decided to distribute guidelines to the public, outlining the appropriate measures residents should take in response to forecasts of high pollution levels. A year later, in March 2003, the Ministry decided to expand pollution forecasts to include more

pollutant types. The accumulated change, though successive, was of small significance and had no consequences on emission levels. Its base of policy change generation was narrow, as changes were only introduced by the MEP.

Discussion

The policy series analyses show that governmental agencies can significantly change policy in a step-by-step process, without initiating major changes. Over the three-year period examined, government ministries and agencies generated 37 policy changes concerning air pollution in Israel, with only two in a negative direction. All this occurred as signals concerning air pollution as a public problem, measured by exposure in the national media, steadily rose. The gradual change corresponds with the broader picture, as, since the 1990s, Israel has gradually moved towards using emission standards of developed countries.

The friction-oriented vs. change-in-standards policy-content analysis, developed in this study, proved to be an effective method for differentiating between policy changes which accumulate to significant change over time and those that do not. Fourteen policy changes improved emission standards or promoted cleaner technologies while 19 policy changes were related to institutional friction costs, with 14 of the latter specifically related to transaction costs. These figures show that the impact of policy changes on the overall change in policy greatly depends on their content type and hence assessment of accumulation requires such analysis. In practice, while vehicle emission standards gradually improved and two new, less polluting vehicle technologies were made available to the public, in the industrial air pollution case policy changes mostly concerned enforcement of longstanding standards especially for the RHIA.

Within the framework of a change-by-change resolution vehicle air pollution policy provides the clearest example of a policy sequence as defined earlier. Policy in this area progressed as a successive flow of policy changes, many of which changed policy at its core by improving emission standards or introducing new cleaner technologies. The ratio between such policy changes and policy changes related to institutional friction is 2:1 (12 changes vs. 6 changes). In addition, many of the policy changes continued changing policy from where previous policy changes left off. For example, the MEP demanded a switch to city diesel in the two largest bus companies. This was followed by an expansion of the directive to another five large companies, followed by changing over the entire diesel vehicle sector to city diesel,

followed by an adoption of the Euro 4 standard for new cars requiring city diesel usage. In contrast, Industrial air pollution policy changes progressed in a relatively weak sequence and in relation to only one of the major polluting industrial zones in the country. The priority given to the RHIA may be related to a plan to move most army training bases to the area. The relative weakness of the industrial air pollution policy is reflected in the fact that 13 out the 16 policy changes in the series were related to institutional friction and also that a third of industrial pollution policy changes was triggered by external events, such as visible pollution incidences in industrial plants. The third sequence concerning the public's exposure to episodes of high pollution is an example of insignificant changes in policy. As such changes are not of much interest to the public it can be assumed that more of such changes were made concerning air pollution. This would be in line with DIPs stance that most policy changes are undereactions.

Differences in the levels of institutional friction between the two sequences can explain the differences in the sequences overall accumulation and in their policy change composition. The key difference in the level of institutional friction amongst the cases stemmed from the impact on institutional costs of strong private sector organized interests counteracting change. Tightening industrial air pollution standards is expected to have negative financial consequences for factories and industrial plants and their owners, some of which have a strong position in the national economy. Negative consequences for private sector organizations may in turn negatively impact the job market and the national economy. Such circumstances impact all four types of institutional friction costs described in DIP: decision, transaction, information and cognitive (Jones and Baumgartner 2005). Moreover, setting more stringent standards for factories and industrial plants includes separate negotiations with each organization. Factories' specific characteristics including financial capacities need to be taken into account. This process adds to both decision-making costs and information costs. Transaction costs may be raised by factories stalling implementation or carrying it out partially. A recent report on random MEP checks, found that from 2000 (when random checks were initiated) until 2007 about 50% of factories polluted above permitted levels (MEP 2015). Finally, the complex process which sometimes involves the interests of strong private sector players may add to cognitive costs as it necessitates increased involvement of high-level decision makers in the policymaking process.

In contrast, although setting more stringent standards for vehicle air pollution has some negative consequences for private sector organizations such as bus companies and road transport

companies, policies usually do not require large investments on behalf of these companies as vehicle emissions are expected to improve only for new vehicles which typically already meet the required standards. In addition, private sector players such as vehicle importers have incentives for improved emission standards as these often allow import of more advanced vehicle models . Hence, costs for vehicle air pollution largely concern organizational adjustment rather than large private sector investments, as costs are usually shared by a multitude of vehicle owners, as are the benefits of cleaner air quality. Furthermore, pollution standards are set nationwide and in a relatively simple process, in comparison to assigning specific pollution standards for factories. Nonetheless, changing vehicle standards does require inter-governmental collaboration and negotiations with other stakeholders.

Based on these findings, a refinement to DIP theory is proposed, whereby policy sequences may emerge under the following conditions: (a) signals continuously point towards a certain direction of change; (b) institutional friction allows for small accumulating changes. These are sequences in the sense that at least some of the policy changes continue policy from where previous policy changes left off. The findings also demonstrate that for some topics, such as air pollution in Israel, most signals may all be in the same direction. This possibility was not considered in the development of DIP (Jones and Baumgartner 2005a) and can be expected in other policy areas as well, in particular for valence issues for which there are no clear organized interests countermobilizing against policy change (Baumgartner and Jones, 1993, 150). Even if policy measures alleviate problematic aspects of issues such as the levels of some pollution types, gradually increasing knowledge and awareness may maintain and raise the issue's severity.

It should be noted that the findings do not rule out the possibility of a future punctuation if signal intensity continues to grow, or even if it does not grow (John and Bevan 2012). The study's short time frame cannot lead to a definite conclusion about the chances of such punctuation. While DIP continues to accurately describe many policymaking processes, this study suggests that one may observe the significant accumulation of small changes, (largely in the same direction) over time in many policy areas. Also, it should be taken into account that these findings were reached within the political institutional context of a coalition parliamentary government system, which is generally considered to be more responsive to public opinion than

presidential or majoritarian systems (Lijphart 2012). In addition, the case study uses the environmental policy domain. Other policy domains may behave differently.

Conclusion

The case of air pollution policy in Israel demonstrates, as several other studies have done, that governmental agencies can significantly change policy in a gradual, step-by-step manner, without making any major changes. This study adds several distinct contributions to the body of literature dealing with gradual and significant change. The change-by-change analyses demonstrate the significance of sequencing in order for a series of policy changes to accumulate. Sequencing occurs when policy changes are logically ordered, each one continuing to advance policy from where the previous policy change concluded. In addition, they also demonstrate that assessing accumulation of change over time requires analysis of policy change type, as policy changes may deal with facets of institutional friction rather than truly advancing policy. The friction-oriented vs. change-in-standards policy-content analysis, which was developed within DIP's conception of institutional friction, proved useful for differentiating between policy changes which accumulate to significant change over time and those that do not. This differentiation may be useful for studying gradual change in other policy fields. It may require some adaptation especially with regard to the types of regulation that represent significant change. The SIV method developed within this study also proved useful, however assigning values does require familiarity with policy-content and the general context in which policies were produced. This is a disadvantage in comparison to the former method.

Another contribution, is the suggested refinement of DIP and eventually of PE theory to include the possibility of a third policymaking mode which may be available to policymaking bodies in addition to initiating uncommon major changes and making routine incremental adjustments. Policy sequences point to the possibility of a more responsive signal-output dynamic, as depicted in several policy responsiveness theories. Specifically, I suggest that DIP should be refined to account for emerging policy sequences resulting from signals that point in a certain direction of policy over an extended period of time and a level of friction that enables series of small accumulating changes. This does not rule out the a policy punctuation occurring in the long run but rather points to the possibility policy sequences within a general PE dynamic of policy change.

All in all these findings explain how the political landscape can appear both stagnant and volatile at the same time while subtle changes are also taking place. During any given period some issues evolve as a policy sequence, others are static and a few go through drastic changes. Hence, when analyzing the government's seemingly routine outputs, we should be sensitive to sequencing. The possibility of sequencing has implications for several theories of the policy process such as MS, ACF and PE. These theories focus on factors and conditions enabling major changes. Yet, they do not specify factors that may lead to significant accumulation of non-major changes over time. This study also has implications for how we interpret the high density of small changes in annual national budget change distributions, as presented in DIP theory (Jones and Baumgartner 2005a; 2005b). There too, we must tune in to sequencing. Some of the small annual changes, assumed to be negligible, may be part of sequences accumulating to significant change. Thus, analyzing change over longer periods of time may produce a more balanced depiction of policy-making dynamics. In contrast, analyzing change in yearly snapshots disregards accumulated "motion". Widespread policy sequences may also explain how less punctuated budget items grow more than punctuated ones (Breunig and Kosky 2012).

There is much room for further research. The proposed refinement of DIP theory needs to be further tested on more cases, in different policy fields, and in other political and institutional contexts. Budget data, which served as a basis for formulating DIP theory, could also be reexamined in the context of policy sequences. More series of policy changes need to be examined with attention to sequencing and to the conditions enabling sequencing, including issue saliency, agencies' signal processing capacities, and friction. Longitudinal studies of single policy issues could shed light on different dynamics and stages in sequencing. In addition, continuing to work with and develop methodologies for assessing accumulation of policy change is also of interest. Finally, other acknowledged theories of the policy process should be challenged to include the possibility of policy sequences as policy outputs.

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Appendix I: Policy Change Descriptions

Table 1. Policy Change Descriptions

PC date	PC description	Change type: change in standards; introducing new technology (*= change to EU standard); change related to institutional friction costs; or other.	SIV & date explanation.	Source D.M.Y, "(title)", (Source initial). (H= Haartezl Hebrew-language newspaper source). Otherwise standard referencing
Vehicle Air Pollution – Pre 2002 (reported in articles from 2002)				
6/2001	The Ministry of Environmental Protection (MEP) issued legally binding orders to the Egged and Dan bus companies to switch to city diesel and reduce their emissions by 50% in three years by various means.	Change in standards*	SIV= 11: moderate expansion of Ministry's activity into stricter regulation against large bus companies; new regulation; a potential for a major effect on pollution levels especially in cities. Date=6/2001: in the graph the PC was placed in December 2001 in order include the PC in the sequence without adding months in 2001 for which articles are not available.	18.03.2002, "The Ministry for Environment: The Fuel Administration is delaying the transition to Low Sulfur Diesel", H.
12/2001	The Minister of Infrastructure (A. Liberman) signed an order for allowing the operation of LPGs in Israel following the decision of the Ministers' Committee for the Economy (MCE), headed by the Finance Minister (S. Shalom), to promote the order.	Promoting new technology (first step in complex multi-agency process)	SIV= 5: moderate expansion of the issue's subsystem into promoting LPGs; new regulation. Date=12/2001: PC date reported in article	14.01.2002, "The Minister of Infrastructure signed a warrant for LPG usage", H.

12/2001	Egged Bus Cooperative and MEP started a catalytic converter experiment.	Information costs	SIV=1 Date=12/2001: estimated date	18.03.2002, “The Ministry for Environment: The Fuel Administration is delaying the transition to Low Sulfur Diesel”, H.
Vehicle Air Pollution – 2002				
5/2002	The National Council for Planning and Building authorized adding liquid gas fuel pumps to gas stations in an amendment to the national plan for gas stations (TAMA 18).	Promoting new technology	SIV=5: moderate expansion of the issue's subsystem to include the national planning subsystem; new regulation. Date= 5/2002: PC date reported in article	14.5.2002, "Fuel pump operation using liquid gas fuel approved", H.
6/2002	MEP commenced a legal investigation against Dan Bus Company for not filling all the requisites of the order it received earlier that year.	Enforcement costs	SIV=3: moderate expansion of the Ministry's activity into legal action against a major bus company. Date= 6/2002: PC date reported in article	26.6.2002, "Criminal investigation against Dan for breach of pollution reduction order", H.
10/2002	MEP gave a legally binding directive to five large bus companies to switch to low sulfur diesel and outlined conditions for emissions reductions	Change in standards*	SIV=5: moderate expansion of the Ministry's into bus transportation standards and potential for moderate effect. Date=10/2002: PC date reported in article	3.11.2002, "Buses in public lines to use low Sulfur content Diesel fuel", H.
10/2002	The government decided to create a committee for the reduction of air pollution with an emphasis on pollution in cities and pollution from vehicles. The plan was presented to the government in 2004.	Decision making costs	SIV=3: moderate expansion of the Ministry into more systematic planning concerning air pollution. Date=10/2002: approximate date – (reported in 10/2004 as performed two years ago).	23.10.2004, "The plan: polluting cars prohibited from entering Tel Aviv", H.

11/2002	The Fuel Administration decided on a national transition to city diesel from May 2003.	Promoting new technology	SIV=9: immediate moderate effect and new regulation. Date=11/2002: Approximate date (implementation -6M)	22.4.2003, "The Technion: transferring to low sulfur diesel will save 160 Shekel per annum", H.
Vehicle Air Pollution – 2003				
1/2003	The Committee for Fundamental Planning Issues authorized adding natural gas pumps to existing gas stations.	Promoting new technology	SIV=1 Date=1/2003: PC date reported in article	23.1.2003, “Plan for building gas refueling stations approved", H.
2/2003	The finance minister signed an order cancelling the purchase tax (19.2%) on the system for conversion of a Petrol engine to a LPG.	Promoting new technology	SIV=5: moderate expansion of issues subsystem's activity to include tax measures; new regulation. Date=2/2003: PC date reported in article	10.2.2003, "Purchase tax cancelled on cars running on LPG", H.
4/2003	The Fuel Administration delayed the transition into city diesel from May 2003 to January 2004	Change in standards* (negative direction)	SIV= (-5): new negative regulation; and immediate negative noteworthy effect on air pollution. Date=4/2003: PC date reported in article	22.4.2003, "The Technion: Transferring to low sulfur diesel will save 160 Shekel per annum", H.
9/2003	The Ministry of Infrastructure authorized a standard for LPG usage. LPGs are allowed on the road.	Promoting new technology	SIV=5: new regulation; creating a standard for LPGs creates potential for moderate effect on pollution levels Date=9/2003: PC date reported in article	22.9.2003, "Israeli government, step on the gas!", H.

12/2003	The Finance Minister and the Minister of Infrastructure set the price for unleaded gasoline to be lower than gasoline with lead in order to reduce incentives for using gasoline with lead and as part of a gradual national transition to using unleaded fuel.	Promoting new technology	SIV=1 Date=12/2003: PC date reported in article	9.2.2004, "Gasoline price reduced by 1.31%; diesel price increased by 2%", H.
Vehicle Air Pollution – 2004				
1/2004	In authorizing Road 461 (off of Highway 6), the Committee for National Infrastructure mandated that the road include an air pollution measuring station built along the road, as well as a system for collecting pollution from water runoff from the road.	Information costs	SIV=3: moderate expansion of subsystem to include the national planning authorities. Date=1/2004: PC date reported in article	22.01.2004, “Road 461 will be built only if a system for collecting pollution will be added”, H.
5/2004a	MOT adopted Euro 4 standards for imported vehicles	Change in standards*	SIV=9: new regulation; potential for a major effect on pollution levels. Date=5/2004: PC date reported in article	9.6.2004, "Ministry of Transport fights pollution: campaign starting Sunday to examine smoke emitting vehicles", H.
5/2004b	MOT authorized the import of hybrid vehicles.	Promoting new technology	SIV=3: potential for moderate effect. (probably triggered by demand form automobile importers) Date=5/2004: PC date reported in article	9.6.2004, "Ministry of Transport fights pollution: campaign starting Sunday to examine smoke emitting vehicles", H.

9/2004	The government decided to reduce the purchase tax on hybrid vehicles from 100% to 40%	Promoting new technology	SIV=5: moderate expansion of subsystem activity to include tax measures and potential for moderate effect. Date=9/2004: approximate date	10.2.2004, "Environment friendly car revolution reaches Israel, first seven cars sold", H.
11/2004	MEP started a criminal investigation against the executives of Dan Bus Company	Transaction costs	SIV=3: moderate expansion of the Ministry's activity into a criminal investigation against a major bus company. Date=11/2004: PC date reported in article	8.11.2004, "Criminal investigation launched against Dan directors due to pollution offences", H.
Industrial Air Pollution – Pre 2002 (reported in articles in 2002)				
12/2001	MOH ordered an epidemiological study in Ramat Hovav.	Information costs	SIV=3: moderate expansion of MOH's activity by conducting an epidemiological study of Ramat Hovav area. Date: estimated date	20.03.2002, "This summer too, the stench continues", H.
Industrial Air Pollution – 2002				
1/2002	MEP performed a second round of 242 surprise checks for factories. Of the factories checked, 60% were found to pollute in excess to their warrants.	Transaction costs	SIV=3: moderate expansion of ministry's activity in doubling the number of checks. Date=1/2002:assuming that the number of checks was determined in the beginning of the year	23.8.2002, "Deviations in release of toxic substances found again in Ramat Hovav", H.
2/2002	The Shafir factory, located in Tel-Aviv, will shut down on June 30th. The relocated factory was obliged to improve its fuel type.	Change in standards	SIV=5: moderate expansion of MEP's activity by closing of a factory with an immediate noteworthy effect on pollution in the area. Date=2/2002: PC date reported in article	14.02.02, “The Shafir factory will soon begin clearing its area plot”, H.

4/2002	The MEP published a report on its 2001 surprise emission checks on factories. Out of 133 checks carried out in 57 factories, more than half of the factories deviated from their approved emission levels.	Other	SIV=3: moderate expansion of the Ministry's activity by publishing factories failures in emission levels. Date=4/2002: PC date reported in article	21.04.02, “Deviations in Air Pollution in Most of the Factories Checked”, H.
8/2002	MEP decided that criminal investigation will be conducted against executives from two Ramat Hovav factories following the second round of surprise checks and against another five factories which breached their allowed pollution levels as was found in surprise inspections (see D2002-4)	Transaction costs	SIV=3: moderate expansion of ministry's activity by criminally investigating executives. Date=8/2002: used date of report on investigation as date of PC.	23.8.2002, "Deviations in release of toxic substances found again in Ramat Hovav", H.
9/2002	The Director of the Southern District in MEP held a hearing for Ramat Hovav Local Council's chairman.	Transaction costs	SIV=3: moderate expansion of the Ministry's activity by conducting hearings for Industrial Zone Chairman. Date=9/2002: PC date reported in article	3.9.2002, "Demand for Ramat Hovav council to disperse due to failure to control air pollution", H.

Industrial Air Pollution – 2003				
1/2003	MEP performed a second round of 86 surprise checks for factories. Of the factories checked, 60% were found to pollute in excess to their warrants.	Transaction costs	SIV= (-5): moderate contraction of ministry's activity due to cutting the number of checks to a quarter in comparison to the previous year; moderate negative change in budget for surprise checks (the number of checks is decided according to the budget allotted for the checks). Date=1/2003: assuming that the number of checks was determined in the beginning of the year	11.5.2004, "Unscheduled examinations in 2003, most plants polluted beyond allowed limits", H.
9/2003a	The Minster of Environmental Protection declared she will set up a committee to investigate the polluting fire in the Haifa Bay Refineries. The committee recommended criminal investigation against the refinery and another factory alongside several other factory requirements to implement in order to ensure such polluting events will not occur in future.	Transaction costs	SIV=3: moderate expansion of the Ministry's activity into issuing an investigative committee and criminal investigation against the Haifa Bay Refineries - Israel's largest refinery. Date=9/2003: PC date reported in article	15.9.2003 " Heavy pollution warning in Tivon removed: Pollution caused by a fault at the refineries", H.
9/2003b	The Minister of Infrastructure instructed the Ministry's executive director to set up an investigative committee for the polluting fire in the Haifa refineries.	Transaction costs	SIV=3: moderate expansion of subsystem Ministry of Infrastructure gets involved in investigating the fire in the Haifa Bay Refineries and (Israel's largest refinery). Date=16/9/2003: PC date reported in article	16.9.2003, "The pollution caused tens of thousands to remain in their homes", H.

10/2003 a	MEP announced it will start a criminal investigation against the ECOSOL facility for treatment of toxic waste (by burning).	Transaction costs	SIV=3: moderate expansion of subsystem. MEP decided to investigate the facility based in RHIZ on the basis of suspicion. Date=5/10/2003: PC date reported in article	6.10.2003, "Criminal investigation against polluting plant in the south", H.
10/2003 b	Following a second fire within a week's time in the electrochemical plant near Akko, the MEP CEO set up an investigative committee.	Transaction costs	SIV=1: Date=13/10/2003: PC date reported in article	3.10.2003, "Testimonies: shabby maintenance caused fire in Akko", H.
10/2003 c	MEP issued a 30 day closure warrant to the Electrochemical Plant in near Akko several days after a fire in the plant. Also, a criminal investigation was initiated.	Transaction costs	SIV=3: moderate expansion of the Ministry's activity into harsher measures against a medium sized factory (Triggered by fault) Date=15/10/2003: PC date reported in article	3.10.2003, "Testimonies: shabby maintenance caused fire in Akko", H. 16.10.2003, "Temporary shutdown warrant for "Electrochemical Industries" factory", H.
11/2003	MEP criminally charged the electrochemical plant near Akko with violation of its license and extended the closure warrant for another 30 days.	Transaction costs	SIV=3:moderate expansion of the Ministry's activity into harsher measures against a medium sized factory (Triggered by fault) Date: 11/2003: PC date reported in article	16,.11.2003, "Charges pressed against Electrochemical Industries factory", H.
Industrial Air Pollution – 2004				
1/2004	Haifa District Municipal Association For The Environment (HDMAE) ordered a dioxin pollution evaluation (without actual measurement) for the Haifa bay area.	Information costs	SIV=1 Date=1/2004: PC date reported in article	28.1.2004, "From this poison Haifa residents have nothing to worry about", H.

5/2004	MEP prepared new business licenses for factories in Ramat Hovav in which they needed to take care of their own toxic wastes instead of using the problematic waste treatment plant. MEP gave a strict deadline for this change. The change concerned the planned establishment of major IDF bases in the vicinity and complaints about odors.	Change in standards	SIV=11: moderate expansion of the Ministry's activity by increasing regulation; potential for moderate effect on problem as it is reasonable to assume that negotiations will soften regulation and effect will be local; new major regulation. Date=5/2004	9.7.2004, "MEP: we have taken action to reduce pollution in plants till the waste treatment plant shuts down, money will be wasted in Ramat Hovav", H.
6/2004	MEP performed 156 surprise checks for factories during 2004	Transaction costs	SIV=3: moderate expansion of ministry's activity Date=1/2004: PC date reported in article	(Ministry of Environmental Protection 2015).
Reducing the Public's Exposure to Episodes with High Air Pollution – pre 2002 (reported on in articles from 2002)				
12/2001	The Ministry of Environmental Protection (MEP) started to provide air pollution forecasts for the Tel Aviv area. It is planned that in the future such forecasts will be provided to other cities, such as Jerusalem and Haifa.	Information/ no	SIV=3: moderate expansion of the Ministry's activity into forecasting pollution levels. Date: Sometime during 2001. In the graph the PC was placed in December 2001 in order include the PC in the sequence without adding months in 2001 which isn't covered in the article database.	14.1.2002, "Soon pollution daily forecast in large cities", H.
Reducing the Public's Exposure to Episodes with High Air Pollution – 2002				

2/2002	MEP decided to distribute guidelines to the public outlining appropriate behavior and reactions to a forecast for high pollution. These guidelines are prepared for distribution across the country.	Information/ no	SIV:1 Date=2/2002 estimated date (implementation - 6M)	14.1.2002, "Soon pollution daily forecast in large cities", H.
Reducing the Public's Exposure to Episodes with High Air Pollution – 2003				
1/2003	MEP is preparing an international tender for a national pollution forecast for all major pollution types. At the time only a NOx forecast was provided and only in the TA area.	Information/ no	SIV=1 Date: 1/2003:estimated date	8.7.2002, "The Ministry of Environmental Protection does not inform the public on air pollution in real-time", H.

Appendix II. Coding by Central Topic of Yedioth Ahronoth Articles

Articles, having the term air pollution and directly dealing with the air pollution issue, were coded by the following topics: general, vehicle, industrial, energy sector and positive reports

Table 2. Coding by Central Topic of Yedioth Ahronoth Articles

G=General
V=Vehicle
I=Industrial
E=Energy sector
P=Positive

Year	Date (D.M)	Title (Heb.)	G	V	I	E	P
1980	2.1	Fine for air pollution		1			
1980	3.1	Driver fined for air pollution		1			
1980	3.1	Driver fined for air pollution		1			
1980	20.2	The "greens" are coming	1				
1980	6.3	Haifa refineries convicted for air pollution			1		
1980	23.3	Air pollution in Cairo- World's highest	1				
1980	4.6	Most industries pollute the atmosphere			1		
1980	6.7	Egged and Dan fined for air pollution		1			
1980	5.1	Air pollution endangers the Taj Mahal	1				
1980	12.5	Demonstration in Beer-Sheva against Makhteshim's air pollution			1		
1980	19.5	Dr. Shoval: Haifa –Israel's most polluted city			1		
1980	27.5	MALRAZ congratulates on rejection of cement factory in Arad			1		
1980	23.6	Haifa considered a clean city					1
1980	9.7	Haifa most polluted city in Israel			1		
1980	10.9	Paradise in the heart of Cairo	1				
1980	22.8	Is Tel-Aviv choking?		1			
Subtotal			**4**	**5**	**6**	**0**	**1**
Year	**Date (D.M)**	**Title (Heb.)**	**G**	**V**	**I**	**E**	**P**
1985	19.2	Main pollution source in Tel Aviv: Reading Gimel station			1		
1985	21.2	Air pollution in Tel Aviv at seven year minimum					1
1985	31.7	Air pollution threatens Tolstoy estate	1				
1985	5.9	Air pollution punishment: repeated test		1			
1985	4.1	Who will move Frutarom?			1		
1985	11.12	To hell with the passengers		1			

1985	30.12	Incitement against Pri-Ze			1		
Subtotal			**1**	**2**	**3**	**0**	**1**
Year	**Date (D.M)**	**Title (Heb.)**	**G**	**V**	**I**	**E**	**P**
1990	3.1	Twin-engine Audi – agile and reduces air pollution	1				
1190	28.1	We'll close the refineries if pollution standards implemented			1		
1990	19.2	Taiwan schoolchildren masked during lessons due to air pollution	1				
1990	27.2	Air can be cleaned without throwing away money			1		
1990	5.3	Shahal: On March 18th we'll close refineries			1		
1990	20.3	Environmental activists managed to trick the ruling party	1				
1990	21.3	Warning : dangerous pollution in Tel-Aviv central bus station		1			
1990	11.4	Laws to prevent pollution at the time of the second temple	1				
1990	20.4	Choking	1				
1990	20.4	Is your house green enough?	1				
1990	20.4	Our environment is in a severe state	1				
1990	20.4	You're polluting a clean state	1				
1990	20.4	It will surely not adversely affect sales			1		
1990	23.5	Three billion Shekels are needed to relief traffic congestion	1				
1990	3.6	Loan to drivers who will replace old cars		1			
1990	19.6	For the first time: summer camp for children with asthma	1				
1990	27.6	Oxygen data insufficient	1				
1990	4.7	No deviation					1
1990	6.7	Our planet	1				
1990	11.7	The dirty secret of communism	1				
1990	23.7	Holon- out of bounds for truck night parking	1				
1990	8.8	Pollution			1		
1990	15.8	Measurement invitation			1		
1990	29.8	Coal cheap the environment suffers				1	
1990	4.9	Cancer causing air in central bus statin		1			
1990	12.9	Air and water pollution increase inadequate treatment of dangerous materials	1				
1990	30.9	120 thousand hurt by contamination from nuclear fuel production plant in Soviet Union	1				
1990	31.1	On a gunpowder keg	1				

1990	12.11	What's cleaner than electricity?	1				
1990	21.11	See what's happening in Haifa			1		
1990	27.11	Discovery: not so pleasant to live in Los Angeles	1				
1990	4.12	Proposal: operate power stations on Marijuana				1	
1990	12.12	Unhealthy to live in Haifa			1		
Subtotal			**19**	**3**	**8**	**2**	**1**
Year	**Date (D.M)**	**Title (Heb.)**	**G**	**V**	**I**	**E**	**P**
1995	5.1	Where has the Hermon disappeared to?			1		
1995	17.1	Refineries will decrease sulfur content in diesel fuel		1			
1995	23.1	Pollution prevention order against Angel			1		
1995	31.1	More stringent pollution standards in Haifa bay			1		
1995	8.2	All about asthma	1				
1995	21.2	Preparing for Poland: Bendori will check pollution levels in Z'anz'e	1				
1995	27.2	Wants to cover Reading with a condom	1				
1995	28.2	Good news: less sulfur in diesel fuel		1			
1995	7.3	Sarid's teeth	1				
1995	15.3	Bendori from Poland: there is an air pollution problem	1				
1995	23.3	Purchase tax cancelled on catalytic converters		1			
1995	22.5	Lev Tel Aviv residents oppose towers in Rothschild Blvd.	1				
1995	30.5	How green is your car?		1			
1995	30.5	Electric car stuck	1				
1995	6.6	Haifa Chemicals contesting pollution levels in air and sea			1		
1995	21.6	Sarid threatens to close Deshanim plant			1		
1995	13.6	Personal order against Kiryat Ata gas farm			1		
1995	26.6	License to pollute			1		
1995	14.7	New law proposals: mini tractors prohibited on beaches	1				
1995	12.7	Environmental art	1				
1995	24.1	Good news: less pollution				1	
1995	27.1	Less garbage less municipal taxes	1				
1995 00	31.1	White cloud on the "green" Sakhne			1		
1995	14.11	Foreign news flashes	1				
1995	4.12	Paris: city under siege	1				
Subtotal			**12**	**4**	**8**	**1**	**0**

Year	Date (D.M)	Title (Heb.)	G	V	I	E	P
2000	7.1	Everything goes	1				
2000	20.1	A war with roots	1				
2000	24.1	How good to be green	1				
2000	8.2	A catalyst also dies sometimes	1				
2000	8.2	Smoke in your eyes		1			
2000	21.2	Asthma : a pandemic?	1				
2000	7.3	Green brainwashing		1			
2000	9.3	Court decides: residents near Tel Aviv central bus station will be compensated for noise and pollution		1			
2000	14.3	Without economic peace we'll all be poor	1				
2000	22.3	Pollution and no rain	1				
2000	10.4	Refinery will improve 95 octane gasoline to meet European standards. Imported car selection to be enlarged.		1			
2000	23.4	Israel on red line of damage to ecology	1				
2000	30.6	They go and park- and they'll pay		1			
2000	4.7	Who will save the water ecology system	1				
2000	11.7	Soon in Israel: gas operated vehicles		1			
2000	17.7	Shrem group establishes nuclear city waste removal company	1				
2000	19.7	Soon in Tel Aviv: electric signs will report pollution levels	1				
2000	19.7	22 Million Shekel to residents suffering from damages from new central bus station pollution		1			
2000	21.7	In the world, war on asbestos has been declared	1				
2000	7.8	Arab couple	1				
2000	8.8	Short is healthy	1				
2000	13.8	Ecology for young children	1				
2000	15.8	In congested Atlanta: more and more women give birth on the way to the hospital	1				
2000	21.8	The road won- nature reserves endangered	1				
2000	22.8	The government approved: gas powered buses by 2001		1			
2000	22.8	We're here for the way	1				
2000	23.8	6 things you should know about fertility treatments	1				
2000	24.8	1500 Israelis die each year of air pollution	1				
2000	29.8	Treatment at the expense of public relations		1			
2000	30.8	Building a coal power plant				1	
2000	30.8	The economy losing 4 billion dollars a year	1				

2000	4.9	Dangerous gases accumulating in your car		1			
2000	4.9	No cars day in Tel Aviv		1			
2000	19.9	Leaving the car at home		1			
2000	19.9	600 cities taking part		1			
2000	24.9	A city with a break		1			
2000	27.9	This is how we are seen	1				
2000	2.1	The president saved from pardon	1				
2000	2.1	Does work do us harm?	1				
2000	10.1	What is your quality of life?	1				
2000	26.1	"One In Nine" organization to help breast cancer victims	1				
2000	31.1	How are you preparing for winter?	1				
2000	1.11	Chinese men impotent due to heavy pollution	1				
2000	16.11	Now it's official: the weather's gone crazy	1				
2000	10.12	New research: wealthy people more prone to cancer	1				
2000	18.12	Galloping forward	1				
Subtotal			**30**	**14**	**0**	**1**	**0**
Year	**Date (D.M)**	**Title (Heb.)**	**G**	**V**	**I**	**E**	**P**
2005	7.1	Deep in the ground			1		
2005	11.1	We are not protected		1			
2005	18.1.	The gas released		1			
2005	21.1	Bad smell in Kfar Vradim			1		
2005	22.2	Why are we being pitied			1		
2005	23.2	Electric company to build four pollution monitoring stations				1	
2005	1.3	Ministry of Transport opposes improvements in Impreza Turbo	1				
2005	1.3	We will not be run over	1				
2005	3.3	Electric trams not running		1			
2005	17.3	Longevity secret: stop eating	1				
2005	21.3	Building of 3500 apartments between Jerusalem and Maale Adumim approved	1				
2005	27.3	Want to enter town? Pay!		1			
2005	3.4	Health news flashes	1				
2005	17.5	Trucks will continue to pollute air		1			
2005	17.5	Continuing to dilate gasoline: ten gas station owners under police investigation	1				
2005	5.6	How to avoid nose dryness and irritation	1				

2005	26.6	Green at resident's expense	1				
2005	4.7	Car damage by dilated fuel	1				
2005	28.7	Fashionable toy	1				
2005	25.8	Concern: air pollution in schools	1				
2005	2.9	Positive energy		1			
2005	10.9	Investigated and found	1				
2005	14.9	A strong odor of elections	1				
2005	19.9	A bus without a driver	1				
2005	7.1	Our car is small and green	1				
2005	9.1	Investigated and found	1				
2005	9.1	How to function with asthma and allergies out of home and on trips	1				
2005	14.1	Prepared gasoline at home? You will not be taxed	1				
2005	24.1	March of folly	1				
2005	7.12	In any case Earth will continue warming	1				
2005	7.12	Economy Committee approves law preventing polluting companies from receiving grants			1		
2005	8.12	Israelis – 2005	1				
2005	13.12	Noise pollution and antennas	1				
2005	16.12	Central cities mayors at pollution conference	1				
2005	27.12	What's this scooter	1				
Subtotal			**24**	**6**	**4**	**1**	**0**

Appendix III: Air pollution Issue Saliency

Results are from Yedioth Ahronoth article database. Search terms: # זיהום<וגם>#אוויר (# allows for common Hebrew prefixes).

Table 3. Air Pollution Issue Saliency

	Air pollution hits	Total number of articles in first Tuesday in November	Total number of articles in first Wednesday of August	Daily average of number of articles	Estimation of the total number of annual articles	Air pollution normalized by total number of articles
1980	36	181	189	185	57720	0.000624
1982	30	211	186	198.5	61932	0.000484
1984	27	185	229	207	64584	0.000418
1986	32	191	195	193	60216	0.000531
1988	54	175	209	192	59904	0.000901
1990	102	163	237	200	62400	0.001635
1992	73	178	249	213.5	66612	0.001096
1994	90	196	212	204	63648	0.001414
1996	59	175	215	195	60840	0.00097
1998	77	207	222	214.5	66924	0.001151
2000	128	210	244	227	70824	0.001807
2002	117	242	229	235.5	73476	0.001592
2004	128	218	209	213.5	66612	0.001922
2006	198	210	240	225	70200	0.002821

II. Punctuations and Trends in Budgetary Change

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Unpublished
To be submitted to Governance

Abstract

A significant literature has developed in recent years contending that public budgeting can be characterized by punctuated equilibrium (PE), which appears to be a characteristic of budgeting in all complex organizations. Nonetheless, several studies and findings suggest that gradual processes of change, which deviate from a PE dynamic. In this study we test the robustness of the PE findings by developing a measure of a "trend" in budgeting: periods during which annual changes move consistently in the same direction over long periods of time. We focus on trending series of changes and on their dynamics by posing two questions A) what share of budget changes are in trends of various lengths? and B) do trending series involve constant and more efficient updating by policymakers to new information, or are they no more efficient than the other series? We test these questions on US federal budget data over the period of 1947 through 2014, with 60 categories of spending consistently defined over time. Our results were quite straightforward. A large proportion of change in budgets occurs within trending series. Nonetheless, trending changes in budgets occur in PE dynamics characterized by inefficient decision-making just as non-trending changes. These results present a strong indication that decision-making processes for other types of policy outputs also occur in PE patterns even if change is advancing in a certain direction over extended periods.

Keywords: budgeting, incrementalism, gradual change, punctuated equilibrium, public policy.

Punctuations and Trends in Budgetary Change

The dynamics of changes in budget functions vary considerably. For example, in the US federal budget, the housing assistance budget function underwent a sharp and drastic change over a period of two years, in 1974 and 1975, rising from 7.5 billion to 147 billion dollars[3]. In contrast, Medicare has climbed from 19 billion to almost half a trillion dollars from 1967 to 2014 in a relatively gradual and stable pattern of growth. A glance at the two series over time would show one with great volatility, with some substantial, but momentary, adjustments, and the other would show a slow but steady rise. If some of the large adjustments were immediately counter-balanced by adjustments in the opposite direction, then the volatile budget series could show no net change over time, whereas the slowly building one could accumulate to a transformation of that policy domain.

A significant literature has developed in recent years contending the public budgeting can be characterized by a punctuated equilibrium (PE) finding, which appears to be a characteristic of budgeting in all complex organizations. The empirical evidence for this theory is impressive as it has been reproduced in many countries and across many levels of aggregation (see for example the studies reviewed in Baumgartner Jones and Mortensen 2017). However, virtually every one of these studies has focused on data that are presented as annual changes. Longer term trends have not been analyzed. Here we test the robustness of the PE findings by looking at budgets over longer time periods. In particular, we develop a measure of a "trend" in budgeting: periods during which annual changes move consistently in the same direction over several years, sometimes decades. We then re-test some basic elements of PE theory to see if they are robust to this concept of budgetary change. We find that they are. Trending series are important elements of budgeting which are invisible in any analysis in which annual changes are combined into a single distribution. They constitute an important share of the US budget, and most likely do in other countries as well. But they are subject to the same inefficiencies and propensities to "catch up" as budget series that do not show long-term trends. This suggests that they are subject to the same underlying decision-making dynamics.

The dynamics of changes in budgets over long periods of time are somewhat "uncharted territory" in the literature. The reason for this is that a significant element of the recent literature

[3] All dollar values in the article are adjusted for inflation and presented as 2009 dollars

on PE findings in budgeting has been to analyze entire distributions, taking history and dynamics out of the picture. A series slowly growing or slowly declining over time obviously differs from one where the rises and declines are randomly or alternately placed in time: one trends, whereas the other is erratic around a mean of zero. Putting all of these in a single change distribution may hide important dynamics. Hence, one such hidden aspect is accumulation over time, as trending changes may accumulate over time to generate much more significant changes. However, these would not appear in analyses of annual changes. For example, a series growing by five percent per year for five years would accumulate to 27.6% change over this period, though it would only appear as five data points of five percent in an analysis of annual changes

So our question is simple: are the PE findings so common now in the international literature on budget change confirmed or contradicted when we use a different methodology, one which explicitly incorporates the possibility that budgetary change may be studied over longer time periods than only a single year? We focus on trending series and pose two questions: A) what share of budget changes are in trends of various lengths? and B) do trending series involve constant and more efficient updating by policymakers to new information, or are they no more efficient than the other series? That is, when we look at trends rather than annual budget changes, do we find similar dynamics, or is the movement to *annualize* the analysis of budgets in the recent literature generating an artifactual set of findings? Similarly, is the movement to look stochastically at entire *distributions* of budgets hiding important dynamics from sight, by missing the fact that much of any budget is made up of series which trend for long periods of time in the same direction?

To motivate our question directly, consider a budget such as that for health care costs. Because of demographic pressures (e.g., the graying of the population), and perhaps amplified by rising technology costs, these costs may rise, even as a share of the entire budget, consistently over time. Further, policymakers may know with some precision the degree of demographic pressure to expect. Therefore, it may be possible for the adjustments to such series to be more proportionate than in other series. The fact that the series trends consistently over time, in other words, may be evidence of proportionate response, breaking a central tenant of the Disproportionate Information Processing (DIP) theory which is at the core of the cognitive overload model of PE theory. Of course, an empirical test may reveal that a trending series is subject to the same under- and over-response dynamics as can be found more generally. Thus,

we can use a comparison of trending and non-trending series as a test of the underlying dynamic of the PE literature. After all, as Jones and Baumgartner (2005) noted in their review of the classic literature on incrementalism, there can be an overall upwards trend in budgets overall, which simply moves the mean percentage change from zero to some positive value. Our analysis of trends, however, should be recognized as distinct from this discussion of a positive mean value for budget change. Trending series move up or down consistently over many years. This would seem most likely where policymakers recognize a growing demographic trend, or where long-term social trends necessitate a downward adjustment that cannot be reached in a single year. If these long-term adjustments allow policymakers to make them in proportion to the social trends they are tracking, then this would violate an essential assumption of DIP and PE theory.

Previous Studies

PE, as well as other central policy process theories, such as multiple streams (MS) (Kingdon [1984] 1995) and the advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith 1993), describes a common pattern of policy change: a stable state of policy which under certain and uncommon conditions may be disrupted by major changes, termed punctuations. Disproportional information processing theory (DIP) (Jones and Baumgartner 2005), provides a behavioral explanation for this pattern. Its main argument is that decision makers typically suffer from a constant overload of information, also referred to as signals, concerning policy issues. Signals concerning policy issues originate from many sources and in accordance to the central limit theorem are assumed to be distributed normally. Because of attention scarcity, the policy system under-responds to most issues most of the time, generating very modest policy changes from year to year, but for some issues it over-responds. The result of these inefficiencies is that output distributions do not resemble (normal) input distributions: they have a slender peak, reduced numbers of cases in the middle or "shoulders," and many cases in the extremes: fat tails. Kurtosis as the measure of the peakedness of a distribution, and budgets with high kurtosis values (simultaneously having many cases in the central peak as well as "fat tails") are taken as evidence for PE processes based on disproportionate information processing.

Budget data provide strong empirical evidence for such inefficiencies in policymaking in Western democracies. A comparative analysis of annual budget changes in seven countries presented a common punctuated equilibrium pattern (Jones et al. 2009). In all cases, the

distributions of annual changes showed the disproportional shape described above and had high kurtosis. These findings were formulized as a general empirical law of public budgets.

As mentioned above, virtually all studies verifying PE patterns of change are based on analyses of annual changes without measuring change over time. There are a few notable exceptions. Epp and Baumgartner (2016) examine the effect of various factors on the intensity of punctuations in the PE pattern. They find that stable budget categories which are strongly influenced by demographic trends, such as Medicare and those related to public pensions, have a negative effect on the intensity of punctuations, while relatively unstable or volatile budget categories such as those related to states of crises have a positive effect. These findings point to the possibility that trending series of changes may have a more stable dynamic of change. Breunig and Koski (2012) show that higher levels of punctuation in a state's budget function correspond to smaller long-term growth. This points to the possibility that small changes accumulating over time may be a significant source of major policy change. All in all these studies point to importance of examining the role of trending series in budgeting. Still, even these studies are based on annual percentage changes, not longer time series.

Cashore and Howlett (2007) raise more explicit concerns with regard to gradually accumulating incremental changes, and they argue that PE findings overlook this important mechanism of policy change. They point to studies describing cases of significant gradual policy change provide support for this concern in various policy areas, such as: forestry (Cashore and Howlett 2006; 2007), agriculture (Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Skogstad 1998), administration reform (Capano 2003) and policy towards indigenous peoples (Howlett 1994). Segal, (2015) on the basis of a high resolution study of air pollution policy in Israel, suggests that the key characteristic for gradual and accumulating changes is sequencing. The idea of a sequence is that policy change in one time period may be a continuation of changes developed in previous time periods. If a series of small to moderate policy changes accumulate into more significant change over time, this can be another mechanism by which substantial policy changes occur. Studies within the historical institutionalist approach portray similar patterns of gradual shifts in institutions, sometimes undetected, occurring over decades (Hacker 2004; Mahoney and Thelen 2010; Pierson 2004; Thelen 2004). We attempt here to operationalize these concepts through our analysis of budgetary trends. At a minimum, we want to be sure that PE findings in budgets are not due to

the practice of ignoring things that might accumulate slowly over time. Annualizing all budget changes and then analyzing the resulting distribution runs this risk.

The Possibility of Gradual but Proportionate Change

The concerns and findings described above can be broken down into two main arguments. The first is that small policy changes may accumulate over time into significant changes, making it possible that large policy changes may come from accretion as well as from punctuation. This possibility, demonstrated in Bruenig and Koski's study (2012), does not negate DIP and the empirical data supporting it, but rather stresses the possibility that large policy changes may come from two sources: punctuations, or gradual accumulations. Within a DIP framework, gradual accumulation may occur if signals are pointing in a certain direction over extended periods of time (Segal 2015). These may be demographic trends or program costs that can be predicted steadily to increase over time (Epp and Baumgartner 2016). In Segal's (2015) study, it was response to steadily increasing environmental threats. Slow but steady can be an important route to policy change.

The second argument is that gradual changes reflect a more efficient policy process, independent of the PE-DIP dynamic. Such a pattern cannot be accounted for in DIP, as its underlying rationale is that decision makers process information inefficiently due to an overload of signals. This inefficient dynamic should not be affected by consistency in policy direction as the gap between signal overload and rationally bounded decision makers' processing capacities should still hold and be of consequence. In other words, even if the central mass of signals is pointing in a certain direction, while driving change accordingly, it should still present an equally difficult information processing task for decision makers in terms of generating proportional responses. Knowing that a trend is likely to be increasing does not tell the precise size of the increase.

In contrast to DIP's stance, Howlett and Cashore (2006, 2007) argue that a central mode of gradual changes is overlooked by theories such as PE, MS and ACF. In particular, they suggest a "progressive incremental" dynamic of change consisting incremental changes and progressing at a high tempo as a parallel mode of policymaking. They demonstrate the mode through a case of gradual and responsive policy in Pacific Northwest forest policy. Their findings describe a case in which existing institutions prompted paradigmatic changes in logging

practices "thermostatically" in order to protect endangered species. The responsive dynamic they describe suggests relatively efficient policymaking: pressure from the outside environment pushes policymakers progressively to adjust policy in response, eventually leading to a major policy change. This brings us to the crux of our examination: is there a widespread mode of more efficient policymaking processes overlooked by PE and DIP?

Another case of more responsive processes of policymaking has also been identified by Skogstad (1998), who found that a gradual change in the European state-assisted agricultural paradigm in the 1990s increased the paradigm's endurance, while the more stagnant paradigm in the United States was eventually overthrown. This is consistent with the emphasis on the "build-up" of pressure in DIP theory. During times when decision makers under-respond to signals, those signals accumulate. Either they dissipate, by random luck, or they accumulate over time if not incorporated into the decisions. This error-accumulation is then the source of punctuations, in the DIP model, as decision makers eventually have to respond to the accumulated crisis, since they did not respond sufficiently to it as it was building. If decision makers were to respond proportionately to signals as they accumulate, then there would be no build-up, and no need for punctuation; this is essentially the Skogstad (1998) example. Efficient processes can go on forever; inefficient ones eventually generate a break-down leading to a punctuation.

A gradual and relatively responsive policymaking mode is also described in studies of policy responsiveness. Stimson et al. (1995) provide empirical evidence that government is responsive to public opinion. Wlezien (1995) argues that responsiveness resembles a thermostat, i.e. when opinion deviates from the current "policy temperature," decision makers adjust policy to match public opinion. In fact, a consistent direction of policy may be an indicator of such responsiveness to consistent signals. Or, if it takes many years to respond to shifting public opinion preferences, then the literature would do well explicitly to incorporate these longer-term dynamics directly into the empirical testing approach. We do so here.

We sum up the gradual change argument in the form of a rival hypothesis to DIP and PE: gradual accumulation is a central mechanism of change occurring in a more efficient and proportional non-PE dynamic. If the hypothesis is true then trending series, in general, should represent more efficient policymaking processes. Consequently, distributions of annual budget changes that are part of trending series would have lower kurtosis values than distributions of annual budget changes that are not in trending series. Conversely, if distributions of annual

changes in trending series show high levels of kurtosis, similar to those of annual changes not in trending series, then gradual accumulation is not evidence of a distinct process of policy change, but compatible with PE and DIP theory.

Methodology

We begin by taking the US budget distribution previously used in many published articles from the Policy Agendas Project web site[4]; it covers the period of 1947 through 2014, with 60 categories[5] of spending consistently defined over time. We normalize first by converting all budget numbers into shares of the annual budget, summing to 100 percent for each year. We then analyze changes in this share. These two steps essentially control for inflation and mean that we are analyzing changes in the share of the budget, understanding that the budget itself may be growing over time. Finally, we developed an algorithm which determines whether or not each annual change in share continues a trend from the previous year. In total, the algorithm was applied on 3,699 annual changes in share.

For each observation, we simply note whether the change continues in the same direction as the previous change, or reverses. If there is a reversal, we note if the reversal was itself immediately offset in the following year. In such a case the reversal would be noted as single year irregularity[6]. We call a series trending if it moves in the same direction for more than *n* years with no reversals except those immediately offset in year following the reversal.[7]

Results

Breaking down these 3,699 annual budget changes into series consistently moving in one direction or another generated 1,124 series. These series ranged from 1 to 21 years in length,

[4] http://www.policyagendas.org/.

[5] We included functions that represent policymaking and excluded financial functions, such as annual offsets (True 2009); we excluded annual changes in share for which the base year was smaller than 100 million 2009 adjusted dollars.

[6] A single year irregularity was defined in the following manner: Let us assume that in year *t* the change in share was in a certain direction, growing or declining; and in year *t+1* the change in share was in the opposite direction; then, in year *t+2,* the change in share returned to the original year *t* direction*;* if the change in year *t+2* offset the change in year *t+1,* then the change in year *t+1* is considered a single year irregularity. In such a case all three years would be considered part of one trend in the direction of the change in share at years *t* and *t+2*.

[7] As an example, this series trends for six time periods: 5, 6, 7, 6.5, 7.1, 8, 7, 6. The first reversal, from 7 to 6.5, was immediately reversed. The second one was not. Therefore the trend stops when the series reaches a value of 8, at which point a new series may begin.

with a mean of 3.3 and a median of 2 (see Figure 1). In Table 1 we compare budgets according to whether they are part of a trend lasting at least four years, and for growing and declining series.

Figure 1. Trends by Length

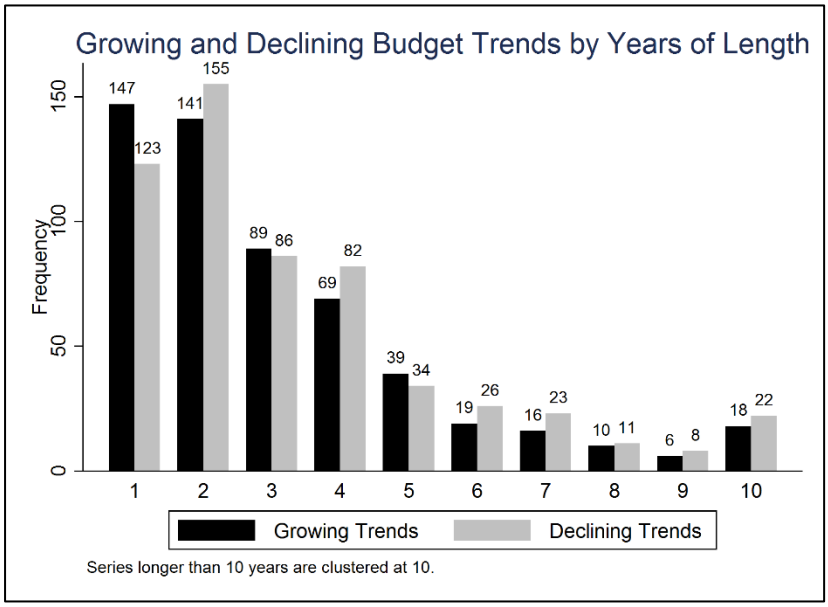

Table 1. Characteristics of Budget Series, by Trending or Not

Trending for Four Years or More?	Growing or Declining	Number of Budget Categories	Percent of Budget Categories	Length (Median)	Annual Change (Median)	Total Change (Median)
Yes	Growing	1,089	29.4%	5	7.7%	77.9%
Yes	Declining	1,221	33.0%	5	-7.2%	-40.9%
Yes	Subtotal	2,310	62.4%			
No	Growing	686	18.5%	2	11.7%	23.7%
No	Declining	703	19.2%	2	-9.88%	-20.8%
No	Subtotal	1,389	37.7%			
Total		3,699	100.0%			

Trending series encompassed 62.4% of annual changes in share, and therefore were twice as common as non-trending series. Note that our use of four years as a cut-off for trending is arbitrary but four years of continued growth or decline in the share of a budget is substantively important. It is therefore of interest to know that more than 60 percent of budget change observations fit into such patterns. These findings provided a clear and definitive answer to our first question concerning the extent of gradual and accumulating changes: trends have an important role in the logic of budgets and many annual changes need to be understood in terms of multi-year trends. Budget officials may seek to phase in policy shifts for many reasons; there

is no reason to think their strategies would be only annual, especially when US Presidents serve fixed terms of four years. Pushing steadily for four years in the same direction can obviously be more effective than attempting to make a change in a single year.

Looking into the relative degree of budget change in both types of series, annual changes in non-trending series have higher absolute values than those in trending series. The medians of annual changes in non-trending series are 11.7% and -9.8%, as compared to 7.7% and -7.2% in the trending series. Of course, trending series see accumulation of these effects whereas non-trending series, by definition, do not. The median of accumulated growth in growing trending series was 77.9%, as opposed to 23.7% in growing non-trending series. The median for accumulated decline in declining trending series was -40.9%, as opposed to -20.8% in declining non-trending series. Again, these findings confirm the central role of trending series in the logic of budgets.[8] At a minimum, we can say that some important shifts in budget share take many years to accumulate.

We also note as others have before us (see Jones and Baumgartner 2005) that growth seems more dramatic that decline: growing trending series have a median of almost 78 percent whereas decline is closer to 40 percent. These findings point to more restrained change in trending declining series in comparison to trending growing series. We found further evidence for this difference in a comparison between trending and non-trending series. The differences in growing series, between trending and non-trending series, were much more accentuated. In other words, declining trending and declining non-trending series more resembled each other than growing series did. For example, in growing series the averages of annual changes were 29% and 47%, in trending and non-trending series respectively. In contrast, in declining series the averages of annual changes were -12.6% and -18.9%, in trending and non-trending series respectively. We note that within the DIP framework one plausible explanation for a more fervent dynamic in growing series is that institutional friction works differently in the two directions. In both cases it apples a threshold force against change. However, in growing trends, once this threshold is surpassed and attention is given to the issue by high level decision makers, friction may drastically drop (Baumgartner and Jones, 1993, Jones and Baumgartner 2005a; 2005b). In declining trends, it may be that government programs tend to continue and resist

[8] Note that our measure of accumulated change compares the budget share at the end of the trend to that at the beginning. Trends may be of any length, however. Therefore we urge caution in interpreting these changes in share.

change all along their decline, hence friction continues to work against decline even after the minimum threshold is surpassed.

Longest and Largest Trends

In order to contextualize to some degree the phenomenon of trending series we carried out an analysis of the longest and largest trends, growing and declining. The results, in top-ten lists, are presented in Table 2. Column A shows the top-ten longest growing trends, ranging from 11 to 21 years. Eight out of the ten trends were in budget functions that are related to either the growing part of technology in society, or to policy issues that have significantly worsened in the post-world war period and have become major national issues, such as social inequality, the cost of health care, crime, the national debt and energy costs (these cases are shaded in grey in column A).

Column B shows the top-ten largest trending and growing series 1461% to 7228% in accumulated growth. We identified five of these trends (shaded grey in the column) as policy issues that were at the center of political and public attention during specific periods, for example: space research in 1950s and 1960s and budget functions concerning social policy in the 1960s and 1970s. These *mega-trends* were most likely processed at the highest level of budget decision-making, i.e. the presidential level (Padgett, 1981).

Moving on to declining trends, column C shows the top-ten longest declining trends, ranging from 12 to 18 years. Column D shows the top ten largest declining trends ranging from -92% to -99%. We identified nine out of the twenty cases (shaded in light grey in the table) as related to post-crises periods, such as periods following a war, a state of emergency or an international crisis. In such times budget repercussions gradually diminish. Two other trends (shaded in dark grey) followed some of the largest growing trends presented in column B and may be periods of a gradual toning-down of mega-trends which may have been overreactions. Figure 2 shows the particular patterns of change of the top four trends in Table 2. The longest growing trend, Medicare, showed steady and gradual accumulation over 21 years from 1975 through 1996. Over this period the function's share from the overall budget rose from 3.6% to 10.4%. Because of demographic pressures (e.g., the graying of the population), and perhaps amplified by rising technology costs, health care costs may rise, even as a share of a budget, consistently over time. Medicare coverage did expand over time though not on an annual basis but rather every few years (Anderson, 2015). Hence, the explanation for the functions steady and

Table 2. Top-ten Longest and Largest Trends, Growing and Declining.

Top ten budget topics categories			
Growing trending series		**Declining trending series**	
A. Longest single trends	**B. Largest accumulated change**	**C. Longest single trends**	**D. Largest declines**
Medicare (21 years; 188%, 1975-96)	Housing assistance (7228%; 8 years; 1967-75)	Other veterans benefits and services (18 years; -55%; 1972-90)	Veterans education, training, and rehabilitation (-99%; 14 years; 1976-90)
Health research and training (20 years; 113%;1983-2003)	Community development (6893%; 6 years; 1964-70)	Space flight, research, and supporting activities (18 years; -51%; 1991-2008)	Other general government (-99%; 10 years; 1947-57)
Interest on the public debt (16 years; 142%; 1975-91)	Space flight, research, and supporting activities (6476%; 12 years; 1952-64)	Income security for veterans (16 years; -48%; 1976-92)	Veterans education, training, and rehabilitation (-98%; 10 years; 1956-66)
Hospital and medical care for veterans (15 years; 105%; 1999-2014)	Social services (4672%; 15 years; 1952-67)	General retirement and disability insurance (excluding social security) (15 years; -85%; 1984-99)	Emergency energy preparedness (-98%; 4 years; 1982-6)
Social services (15 years; 4672%; 1952-67)	Education: training and employment (4041%; 6 years; 1952-58)	Veterans education, training, and rehabilitation (14 years; -99%; 1976-90)	Disaster relief and insurance (-97%; 10 years; 1978-88)
Federal employee retirement and disability (15 years; 232%; 1967-82)	General purpose fiscal assistance (3719%; 6 years; 1967-73)	Department of Defense-military (14 years; -49%; 1984-98)	International security assistance (-95%; 4 years; 1974-78)
Space flight, research, and supporting activities (12 years; 6476%; 1952-64)	International development and humanitarian assistance (3520%; 7 years; 1949-56)	Community development (13 years, -76%; 1976-89)	General purpose fiscal assistance (-95$; 11 years; 1976-87)
Consumer and occupational health and safety (12 years; 96%; 1966-78)	International security assistance (1461%; 4 years; 1970-4)	Agricultural research and services (13 years; -30%; 2001-14)	Criminal justice assistance (-95%; 19 years; 974-83)
Federal litigative and judicial activities (12 years; 97%; 1983-95)	Farm income stabilization (1252%; 5 years; 1978-83)	Federal employee retirement and disability (13 years; -28%; 1996-2009)	Veterans education, training, and rehabilitation (-93%; 6 years; 1947-53)
General science and basic research (11 years; 59.4%; 1983-94)	Central personnel management (1248%; 5 years; 1952-7)	Income security for veterans (12 years; -49% 1955-67)	Emergency energy preparedness (-92%; 5 years; 1988-93)

dramatic rise does not lie solely in a gradual decision-making process but is also related to trends in other variables, external to policy-making, though affecting the budget.

The longest growing trend, Medicare, showed steady and gradual accumulation over 21 years from 1975 through 1996. Over this period the function's share from the overall budget rose from 3.6% to 10.4%. Because of demographic pressures (e.g., the graying of the population), and perhaps amplified by rising technology costs, health care costs may rise, even as a share of a budget, consistently over time. Medicare coverage did expand over time though not on an annual basis but rather every few years (Anderson, 2015). Hence, the explanation for the function's steady and dramatic rise does not lie solely a gradual decision-making process but is also related to trends in other variables, external to policy-making, though affecting the budget.

The largest accumulated change in a trending sequence is Housing Assistance. Over the period of 1967 through 1975, the function grew by 7,228%. The trend pattern includes a gradual buildup of change over 6 years before the budget doubled in 1974 and then quintupled in 1975. It demonstrates that budget punctuations do not necessarily occur in the context of insignificant policy preceding the punctuation, but rather may follow a significant period of "softening up" (Kingdon 1995). Indeed, huge spending increases may require the build-up of infrastructure and institutions, suggesting that they cannot easily come about in a single year. Of course, it depends on the type of spending, since income transfers for example can indeed be changed dramatically without a corresponding increase in bureaucratic infrastructure.

The longest declining trend, Other Veterans' Benefits and Services (1972 through 1990), and the largest declining trend, Veterans' Education, Training, and Rehabilitation (1976 through 1990), both display steady decline in budget size to almost zero, following a period of substantial spending. Similarly to Medicare, the steady change is due to changes in factors affecting budget size rather than a steady change in policy. With fewer veterans during that period, spending naturally declined and the decline continued for a long time, since the number of veterans showed no dramatic breaks but moved only gradually. In sum, several of the most dramatic examples of long-term trends in budgeting, especially these two relating to declines, have to do with demographics. Spending moves gradually when the number of those eligible to benefit from the spending evolves gradually. As Epp and Baumgartner (2016) show, punctuations are less drastic in budget functions which are influenced by trending factors in society. This dynamic is

in contrast with suggestions in the literature that gradual shifts in budgets reflect slowly evolving official thinking or the steady implementation of new policies in response to changing circumstances. The largest examples of gradual declines in budgets in fact reflect steady policy formulae interacting automatically with shifting demographics. perhaps amplified by rising technology costs, health care costs may rise, even as a share of a budget, consistently over time. Medicare coverage did expand over time though not on an annual basis but rather every few years (Anderson, 2015). Hence, the explanation for the function's steady and dramatic rise does not lie solely a gradual decision-making process but is also related to trends in other variables, external to policy-making, though affecting the budget.

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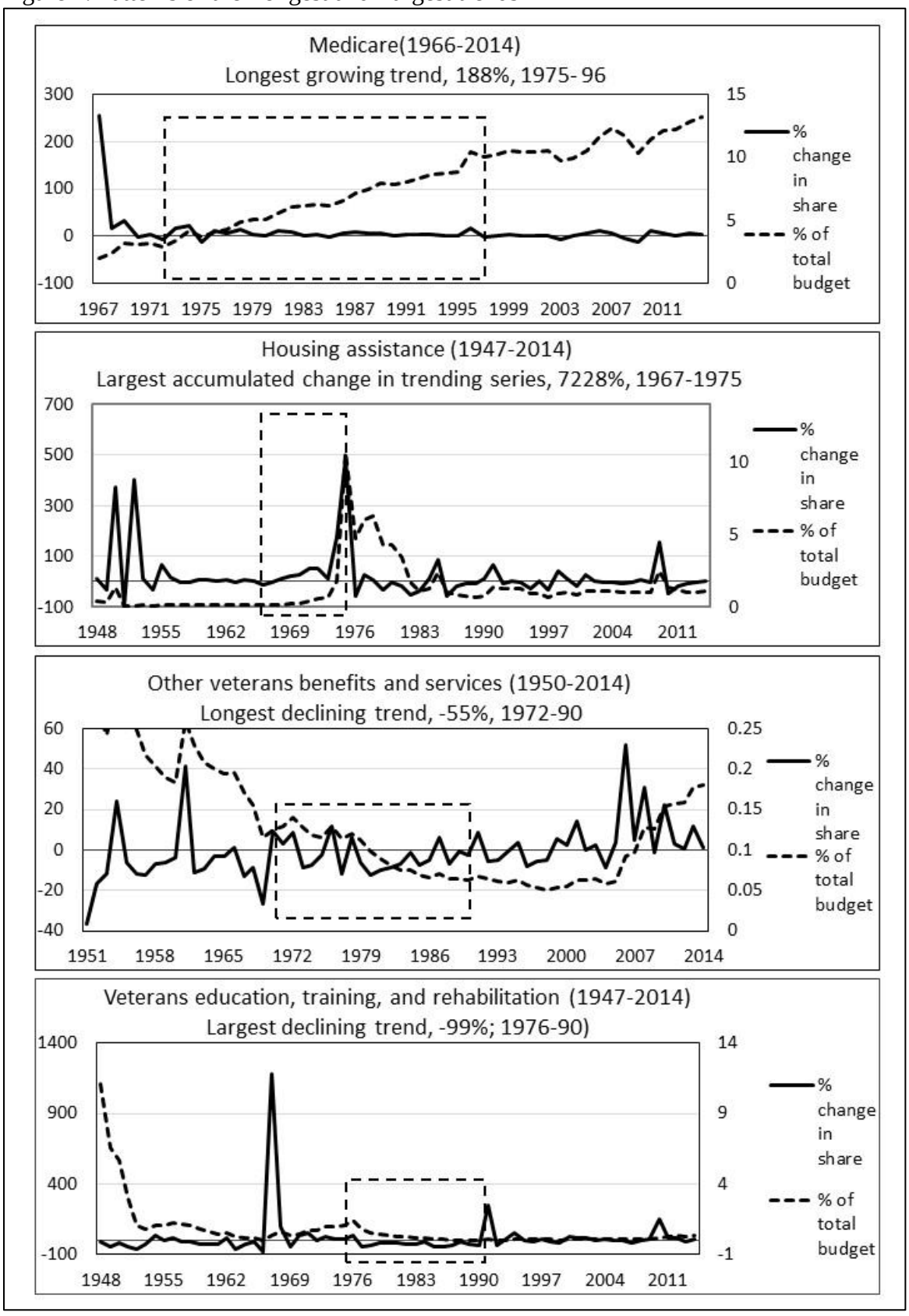
Figure 2. Patterns of the Longest and Largest trends



circumstances. The largest examples of gradual declines in budgets in fact reflect steady policy formulae interacting automatically with shifting demographics.

Disproportionality in Trending Series

The previous short assessment should clearly answer the question of whether gradual changes are important elements of the budgetary process; they are. But another central question is whether the fact that a series slowly adjusts in the same direction for long periods of time is perhaps an indication that the decision makers are able to keep up with slowly shifting social or demographic trends. DIP and PE theory are based on a model of decision-making which suggests that decision makers are consistently overwhelmed by the complexity of the world around them, unable to respond proportionately. Therefore we want to know if evidence of proportionality in budgeting differs significantly in those series which are parts of significant trends compared to those which are not part of a trend.

We examined the hypothesis concerning the role of gradual and more efficient changes by measuring the disproportionality of the distribution of annual budget changes in trending series and in non-trending series, and comparing between the results. Disproportionality was measured by using the leptokurtosis statistic (LK). LK measures the central peak's extremity and the extent of "tailedness" in distributions. It is similar to kurtosis, though it is less sensitive to single extremities the *x*-axis, and therefore it provides a more general representation of tailedness more suitable for our analysis. LK values range from zero to one, with 0.123 the LK of a normal distribution. Table 3 breaks out each annual budget change observation by the length of a trend of which it is a part.

Table 3. LK Values for Series of Different Lengths

Trend length	N	LK
1-2	856	0.579
3	528	0.560
4	604	0.456
5-6	635	0.650
7-9	567	0.517
10+	504	0.415
Non-Trending (three years or less of a trend)	1,389	0.574
Trending for four years or more	2,310	0.547
All changes	3,699	0.568

As we saw in Table 1, 2,310 changes are in trends lasting four years or more, and 1,389 are in trends lasting less than four years. Table 3 shows that these observations have almost identical LK values: 0.547 for trending series and 0.574 for non-trending series. Looking at the individual series (clustered by trend length so that the N's are roughly comparable and over 500 in each case), all values are high, and the movement is idiosyncratic rather than steadily in one direction or another. In the last category, with trends lasting more than a decade, the LK value does appear to be somewhat lower. Overall, however, Table 3 shows that consistency in the direction of change does not increase the efficiency of budget making decisions. Decision-making processes within trending series of changes also evolve in a disproportional PE dynamic. In other words, it is equally difficult for decision makers to generate proportionate policy changes for policies which are advancing in a constant direction. The results reject the hypothesis that gradual accumulation is a central mechanism of change occurring in a more efficient and proportional non-PE dynamic. They also present a strong indication that decision-making processes for other types of policy outputs occur in PE patterns even if change is advancing in a certain direction over an extended period.

We can do one final test. Figure 3 shows the distribution of changes at the core of the main result in Table 3: Part A shows those changes not part of a long series, and Part B shows those observations which are part of a trend of four years or longer. Figure 3 conforms the results from Table 3. Figure 4 presents a different and perhaps more revealing comparison. It compares not the annual percentage changes, but the beginning and ending values of the trending series. Thus, to go back to our earlier example, if a series moved up by five percent each year for five years before reversing, we would call this one trend accumulating to 26.5 percent total change. In the figure and table above, it would be recorded as five values of five. Figure 4A shows all 1,124 trends that we identified, and 4B shows the longer trends, those lasting three years or longer (N = 558).

Figure 3 conforms the results from Table 3. Figure 4 presents a different and perhaps more revealing comparison. It compares not the annual percentage changes, but the beginning and ending values of the trending series. Thus, to go back to our earlier example, if a series moved up by five percent each year for five years before reversing, we would call this one trend accumulating to 26.5 percent total change. In the figure and table above, it would be recorded as

five values of five. Figure 4A shows all 1,124 trends that we identified, and 4B shows the longer trends, those lasting three years or longer (N = 558).

Figure 3. Annual Changes in Budget Share, Trending and Non-Trending Series Compared.

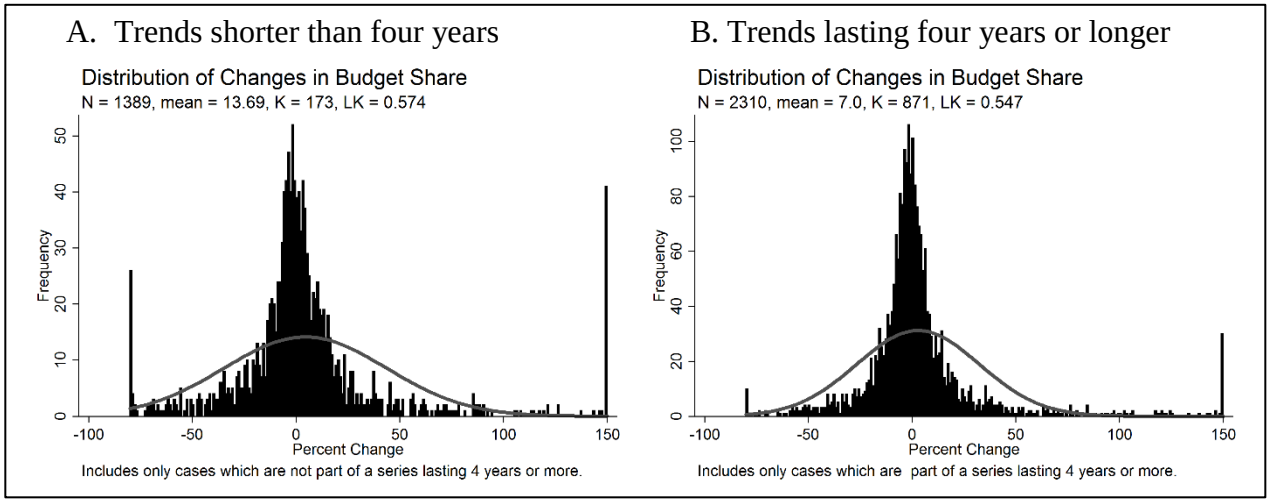
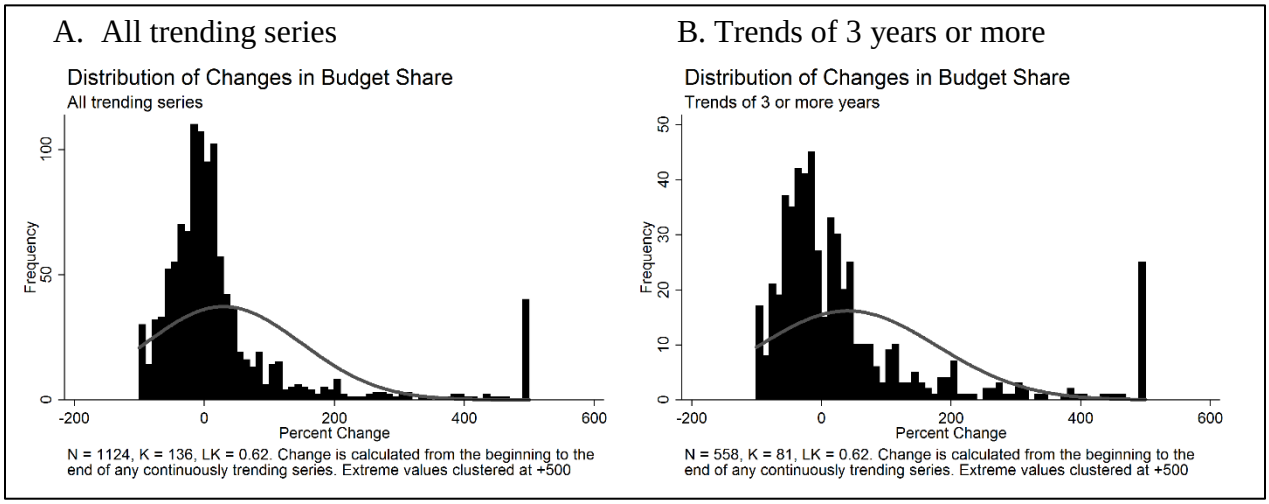


Figure 4. Cumulative Changes in Budget Share, Trending Series and Longer Trending Series.



When we look at the cumulative change from the beginning to the end of a budgeting trend, of course the degree of change is greater. We cluster the values at +500 percent change because many of them go beyond that level of change. But in looking at all the trends our algorithm identified, or in looking only at the top half of those trends (those lasting over three years), the LK value is identical: 0.62. The distribution reflects a similar degree of status-quo bias reflected by the high central peak, the same pattern of fewer cases in the shoulders of the distribution, and then again large numbers of cases far out in the tails. The shape of change is

unaffected by our analysis of annual changes in budgets or in looking at the end results of budgetary trends.

Conclusion

In this study, we examined gradual changes in budgets with two central questions in mind: (a) what share of budget changes are in trends of various lengths?; and (b) do trending series involve constant and more efficient updating by policymakers, in contrast to the expectations and theory of PE and DIP? We tested these questions on the US federal budget over a period of 68 years with 60 categories[9] of spending consistently defined over time.

Our results were quite straightforward. A large proportion of changes in budgets occur within trending series. Congruently a large proportion of change in budgets occurs within trending series. Nonetheless, gradual changes in budgets occur in PE dynamics characterized by inefficient decision-making. These results present a strong indication that decision-making processes for other types of policy outputs also occur in PE patterns even if change is advancing in a certain direction over extended periods.

Applying a gradual change approach to the study of governmental budgeting exposed additional noteworthy findings and interesting directions for future research. We identified gradual and directional changes in budget, which most probably result to some extent from gradual and directional societal changes (see also Epp and Baumgatner 2016). In addition, in our analysis of the longest and largest trends we identified several growing trends in fields directly related developments in science and technology and to major social issues. We also identified two general contexts for the longest and largest declining trends: periods following a crisis for which consequences gradually diminish, and periods following very large *mega-trends* which may be gradual counter-reactions. We also found indications that declining trends are more restrained in their pattern of change in comparison to growing trends. This may be due a difference in the way friction on growing trends in comparison to declining trends.

In conclusion, considering change dynamics over time adds an important dimension to the study of budgets. While analyses of annual changes reveals the parts, in terms of size, that form changes in budgets, considering change over time reveals how these parts are connected

[9] We included functions that represent policymaking and excluded financial functions, such as annual offsets (True 2009); we excluded annual changes in share for which the base year was smaller than 100 million 2009 adjusted dollars.

and their patterns of change. Applying this approach, we found that trends are very important parts of budgets. However, even if the government is faced with a continued trend over many decades, there is still no reason to expect that the policymakers respond proportionately. Therefore the DIP insight at the core of PE is still operating.

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III. Patterns of Policy Change as Interplay Between Signals and Friction: A Comparative Case Study of Road Safety and Air Pollution Policies in Israel

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Unpublished
To be submitted to the Journal of Public Policy

Abstract

This study examines the way in which the interplay of signal strength and levels of institutional friction affect policy change patterns for issues that move in a consistent policy direction over long periods. The research investigates two hypotheses that extend previous punctuated equilibrium (PE) literature to focus more closely on the combined impact of signals and institutional friction. The first hypothesis contends that variance in signal strength and institutional friction will result in four policy change patterns: slow incremental change; gridlock; infrequent punctuated change; and frequent punctuated change. The second hypothesis expects that at a certain gap between signal strength and the level of institutional friction, a gradual, relatively proportional and accumulating policy change pattern is likely to occur. The study employs a mixed methods approach to investigate three longitudinal policy change case studies in Israel over approximately fifty years: road safety policy, vehicle air pollution policy, and industrial air pollution policy. Findings validate both hypotheses. Further study is needed to replicate these findings across a broader range of countries and policy areas.

Keywords: Policy change patterns; policy process; punctuated equilibrium; incrementalism; policy sequence; policy signals; institutional friction; road safety; air pollution.

Introduction

Is there a general underlying pattern of change for governmental policymaking? Punctuated equilibrium PE theory, as well as other policy process theories, such as multiple streams (MS) (Kingdon [1984] 1995) and advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith 1993), portray a common pattern of policy change: a stable state of policy, which may occasionally be disrupted by infrequent major changes (Wison, 2000). In this study, we expand our understanding of the PE pattern by examining pattern variants and their relationship to the interplay between key variables in PE theory, which drive and constrain policy change and ultimately shape its pattern. We also examine the conditions for an exception to the PE pattern, occurring within policy sequences. This is a pattern of gradual accumulating change that does not include major changes although policy does change significantly over time (Segal 2015).

PE contends that the basic pattern of policy change is a general state of policy equilibrium, punctuated by short bursts of intense change, which occur under exceptional conditions (Baumgartner and Jones 1993). Large datasets of annual budget changes in several Western countries, at both national and local levels, strengthened the case for a general PE pattern (Jones and Baumgartner 2005; Jones et. al. 2009). According to disproportionate information processing theory (DIP), which presents a decision making rationale for PE, the attention-driven choice of policy makers is principally driven by signals and constrained by institutional friction (Jones and Baumgartner 2005a:336). Signals from the surrounding environment overburden policy makers' limited attention and signal strength impacts policy makers' issue-attention focus (Bertelli and John 2013). Institutional friction refers to the overall institutional costs that restrain policy change (Baumgartner, Green-Pedersen and Jones 2006:959; Jones and Baumgartner 2005a; Jones, Sulkin and Larsen 2003:155-156). Jones and Baumgartner (2005a:339) theorize the general impact of signal and institutional friction intensities, however the interplay between the two and its impact on policy outputs is not comprehensively theorized and tested. This is one undertaking of the study.

The second undertaking concerns investigating a policy change pattern of gradual and accumulating change that is not explained in PE. Howlett and Cashore (2009) criticize this as a weakness in PE that needs to be addressed, while pointing out cases that demonstrate such change patterns (Capano 2003; Cashore and Howlett 2006; 2007; Chaqués and Palau 2009; Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Howlett 1994; Kay 2011;

Skogstad 1998; Weaver 2010). Segal and Baumgartner (2016) have examined the apparent contradiction between evidence for gradual changes and PE by analysing trending series of changes in United States (US) federal budgets. They found that more than 60% of budget changes occurred in directional trends of four years or more. However, within these directional series of budget changes, the distribution of annual budget changes was still found to be highly disproportional, in that they were made up of many small changes, few medium changes, and a disproportionate amount of extreme changes – relative to a normal distribution. These findings suggest that cases of more moderate, gradual change are still the exception even within directional budget change series.

We continue the examination of policy change patterns that occur within directional series of changes; similar to Segal and Baumgartner (2016) we examine cases in which policy advances almost exclusively in one direction over the period studied. However, our study differs in two main aspects: First, we study policy change patterns in three policy areas outside the budget domain. This is important to test whether findings concerning budget policy hold for policy changes in other policy domains. Second, we perform our examination at a meso-level resolution using a mixed methods approach that combines quantitative and qualitative methods, allowing for a closer examination of directional policy change patterns. Our analysis takes into account both the number and the content of policy changes in three longitudinal case studies over a period of 50 years.

The three policy issues examined in this study are industrial air pollution, vehicle air pollution, and road safety. The impact of the interplay between signal strength and institutional friction on policy patterns is theorized and then comparatively examined in the three cases. The article begins with a review of the key theories of policy change patterns. Next, the role of signal strength and institutional friction in impacting policy change patterns is examined, and two hypotheses are advanced. Then the research design is outlined, followed by a description and discussion of the results. The article ends with conclusions drawn from the research findings.

Patterns of Policy Change

The underlying pattern of policy change, common to central policy process theories, PE, MS and ACF, is one of a stable state of policy, which may occasionally be disrupted by infrequent major changes. This pattern has been recognized in numerous case studies within the context of all

three theories aforementioned. For example, Baumgartner and Jones (1993) identified this pattern in several policy areas in the US including nuclear power, pesticides, smoking, alcoholism, drug abuse, and child abuse. PE has also been identified as a general pattern in budget allocations (Jones and Baumgartner 2005a). A comparative analysis of annual changes in national budget functions in seven such countries presented a common punctuated equilibrium pattern (Jones et. al. 2009). In all cases, the distribution of annual changes had high kurtosis, i.e., in relation to a normal curve the distributions had a very high central peak, representing an abundance of negative and positive small changes; missing shoulders, representing an absence of medium-size changes; and fat tails, representing a substantial number of large and very large changes. Assuming that signals concerning policy issues are generated from a multitude of sources and should therefore be normally distributed, the excessive central peak, missing shoulders and fat-tails in the distribution of annual budget changes indicates disproportionality in budget related decision-making and generally in governmental policymaking. These findings were formulized as a general empirical law of public budgets (ibid).

Disproportional information processing theory (DIP) (Jones and Baumgartner 2005a; 2005b) provides a behavioural account for a PE pattern in policymaking, as an equivalent to Lindblom's behavioural explanation for incremental policymaking (1959; 1979). Its underlying rationale is that decision makers typically suffer from a constant overload of information and signals concerning policy issues. Thus, most issues receive too little attention. However, occasionally, signals concerning a new critical issue or a previously neglected critical attribute of an issue rise sharply and the issue or attribute is "discovered" by policy makers and receives high levels of attention. This shifts the magnitude of policy change accordingly. Hence, disproportionate information processing on behalf of decision makers results in both under-reactions and over-reactions to signals, which results in disproportionately-sized policy outputs. Disproportionate information processing is amplified by institutional friction that adds a threshold to government agencies' reactions to signals from their environments.

The interplay between signals, disproportional information processing on behalf of decision makers, and institutional friction generates the PE pattern. Understanding of this mechanism can be refined to examine how the interplay between different strengths of signals and different levels of institutional friction generate variants of the PE pattern. We present a theoretical framework for this in the next section. Within the suggested framework, we also deal

with an exceptional case of policy change according to PE theory, one of gradual, though significant change that occurs in a relatively proportional pattern, that is, progressing towards significant change without any sharp punctuations.

Several studies explicitly describe cases of gradually accumulating policy change. This pattern of change has been identified in several policy areas including forestry (Cashore and Howlett 2006; 2007), agriculture (Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Skogstad 1998), administration reform (Capano 2003), financial sector (Kay 2011), pharmaceuticals (Chaqués and Palau 2009), public pensions (2010), policy towards indigenous peoples (Howlett 1994) and air pollution (Segal 2015). Cashore and Howlett (2007) criticize PE, ACF and MS, which all share an exogenously-driven paradigmatic change perspective, for not addressing a wider range of policy change types such as non-paradigmatic, though significant, gradual changes. Segal (2015) proposes that small changes regarded as mostly insignificant in PE, may be part of policy sequences, which are series of small to moderate policy changes that accumulate to more significant change over time.

It should be noted that several strands of political research also describe processes of gradual policy change. Studies within the historical institutionalist approach portray similar patterns of gradual shifts in institutions, sometimes undetected, occurring over decades (Hacker 2004; Mahoney and Thelen 2010; Pierson 2004; Thelen 2004). Research on policy responsiveness also points to the possibility of gradual, accumulating change. A sizeable body of literature argues that government policy is responsive to public opinion (for a review of the literature on this topic see Burstein 2003) in a way that can lead to gradual policy change. For example, Wlezien (2004) describes the process of policy responsiveness as a thermostat: When policies are out of line with public opinion, politicians "turn" policy to the temperature that they perceive the public to prefer. Therefore, if signals continually point to a certain direction of change over an extended period of time a gradually accumulating policy sequence should emerge.

The literature on policy change, it seems, presents a contradiction. On the one hand, there is strong evidence for PE patterns and disproportionate policymaking, while on the other hand a sizeable body of literature describes gradual change and more proportional policymaking. Segal and Baumgartner (2016) examine this apparent inconsistency by checking for disproportionality in trending series of budget changes. By isolating all trending series of four years or more in US

federal budgets from 1947-2014, they found that over 60% of annual budget changes occurred within such trending series. Nevertheless, the distribution of budget changes within trending series displayed a similar level of disproportionality to those not in trending series. In other words, within directional series of budget changes, change patterns are still characterized, in relation to normal distribution, by many small changes, few medium changes and more large changes than expected. Nevertheless, as most policy changes are small, series of directional non-major changes are likely to have a significant role in public policymaking.

Signals, Institutional Friction, and Patterns of Policy Change

This study furthers previous work on policy change patterns where policy change occurs in a general direction over long periods of time. Extending previous research, and within the PE and DIP theoretical frameworks, we examine two key factors that affect patterns of policy change, signals and institutional friction, and ask how these factors affect policy change patterns and whether they can create conditions for gradual and relatively proportional change. The study poses two questions: 1) What is the impact of varying levels of signal strength and institutional friction on policy change patterns that occur within unidirectional policy change series? 2) Are there conditions under which gradual, accumulating, relatively proportional policy change can be expected to occur? As a first step, we contend with these questions theoretically.

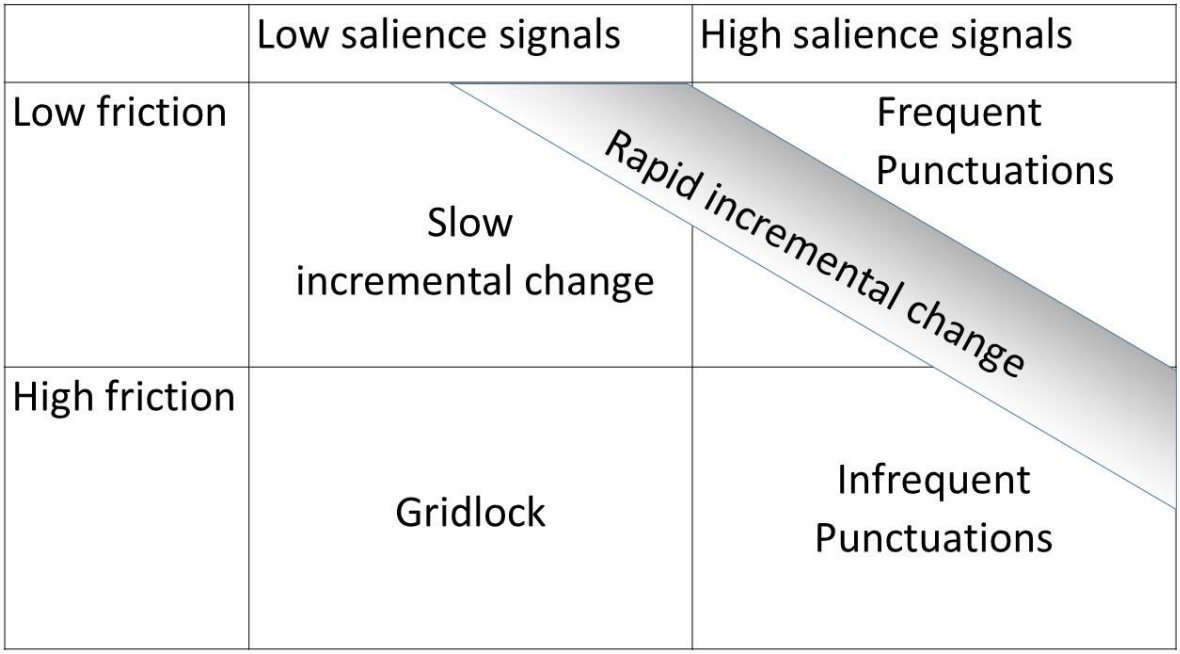
Studies that discuss the relationship between signals and public policy change have established the importance of signal strength as a driving force for change; strong signals have been determined to prompt policy output and policy change (Bromley-Trujillo, Poe, and Leising 2014; Burstein 2003; Franklin and Wlezien 1997; Page and Shapiro 1983; Penning-Rowsell, Johnson and Tunstall 2006; Wlezien 2004). Given policy makers' limited-attention, high-salience signals are much more likely than low-salience signals to gain policy makers' attention (Jones and Baumgartner 2005a). Accordingly, it is reasonable to assume that cases that progress in a certain direction of change over an extended period of time are driven by signals that are inclined in the same direction as well.

Institutional friction, in contrast, is a main element that restrains policy change, increasing the disproportionality of policy change patterns. Institutional friction is composed of four main types of costs that restrain policy change: decision costs, transaction costs, information costs, and cognitive costs (Jones and Baumgartner, 2005a). Decision costs are the costs

associated with reaching agreement about policy change; this includes bargaining costs and institutionally imposed costs in the decision-making process. Transaction costs are the costs involved in implementing a policy decision, once agreement has been reached. Information costs are the costs of obtaining information regarding the relevant policy change. Finally, cognitive costs are the costs associated with the limited capacity of human agents within an institution to be cognizant of all policy issues requiring change.

In addition, DIP holds that disproportional information processing on behalf of decision makers is an inherent state and therefore at any level of institutional friction outputs should create a disproportional policy output pattern. Nevertheless, signal and friction levels should affect policy outputs over time (Jones and Baumgartner 2005a). In accordance with these principles, we distinguish four cases in a two-by-two table according to combined low or high levels of signal salience and institutional friction (Figure 1).

Figure 1. Policy Change Patterns as an Interplay of Signal and Institutional Friction Level



Low signals-low friction: A weak driving force and a weak constraining force in the context of DIP should result in *slow incremental change*. This would be found in the central peak of the annual change distribution.

Low signals-high friction: A weak driving force working against a strong constraining force in the context of DIP should result in *gridlock*. This would be found in the central peak of the

annual change distribution though closer to the Y-axis (zero change) than changes in the low signals-low friction category.

High signals-low friction: A strong driving force and a weak constraining force in the context of DIP should result in an *intensive PE pattern* comprised of relatively frequent major changes punctuating periods of stability.

High signals-high friction: A strong driving force and a strong constraining force within the context of DIP should result in a *constrained PE pattern* comprised of relatively infrequent major changes punctuating periods of stability.

The four types can all be found at different points in the PE pattern, and together they create the typical high kurtosis distribution of annual changes. It should be noted that cases of low salience punctuations may also exist (John and Bevan, 2012) and these are not accounted for in our table.

With regard to the second question concerning conditions for rapid incremental change under DIP as detailed above, there is no combination of high/low institutional friction and high/low signal strength at which we would anticipate a proportional policy change pattern. However, according to Lindblom's incrementalism (1979), policy change advances in small policy change steps, leading to the expectation that policy change patterns will occur in a proportional pattern (Jones and Baumgartner 2005a:326-328). Whilst DIP has ascertained that most policy change patterns are in fact disproportional, it does not discount the incrementalism thesis. DIP claims that incrementalism is fundamentally correct, but errs in failing to account for the fact that "*information that is ignored will accumulate over time, producing occasional lurches or policy punctuations*" (Jones and Baumgartner 2005a:350); this is what creates disproportionality in policy change patterns. This raises the theoretical question whether there *is* some combination of signal strength and institutional friction intensity at which we could expect gradual, accumulating policy change to occur in a proportional pattern, which can also be described as rapid incremental change (Howlett and Cashore, 2009). We propose that a crucial element in answering this question is the gap between signal strength and the level of institutional friction. We argue that there should be an interval at which signals are strong enough to prompt attention and change but not strong enough to create major punctuating changes, and friction is at a level that allows for gradual, accumulating change and prevents rapid intense change, without being so high as to produce gridlock. This interval is shown in

Figure 1 as a diagonal strip in which signal strength is always higher than friction intensity. It is termed rapid incremental change.

Based on the expectations outlined above, we advance two hypotheses: *Hypothesis one*: high/low signal strength and high/low institutional friction will impact the pattern of policy change including major policy change frequency, generating four archetypal patterns: slow incremental change, gridlock, intensive PE, and constrained PE. *Hypothesis two*: there is a certain interval between signal strength and institutional friction level at which gradual, accumulating change will occur in a relatively proportional pattern.

Research Design

In order to test our hypotheses we examined three policy issues over a period of about 50 years, from approximately 1960-2007, during which time change mostly occurred in one direction. We selected cases in which signal strength and institutional friction varied both between and within cases. The three cases are road safety policy, vehicle air pollution policy, and industrial air pollution policy in Israel. By selecting multiple cases from one country, we control for inter-country variations such as political culture and institutional structures. For each case, we measured issue saliency as an indicator of signal strength, qualitatively assessed institutional friction, and assembled a timeline of policy changes. In all cases policy progressed to more stringent standards over time.

Issue saliency, an indicator of signal strength, was measured by the annual number of newspaper articles that contained each issue's key term, either *air pollution* or *road accident,* in Israel's most popular newspaper in the period studied, *Yedioth Ahronoth.* We sampled and coded 40 years in 4-year increments from 1960-2000. The data breakdown is available in appendix III. As the size of a newspaper, in terms of the average number of articles in a single edition, may change over the years, we sampled its size and used the results for normalizing our issues' related article count. The estimated number of annual articles was determined by sampling the number of articles in two days, averaging between them, and multiplying by 6 days (in Israel papers are published six days a week) and 52 weeks. The days used were the first Tuesday of November and the first Wednesday of August, both are periods without any Jewish festivals that affect the newspaper's format.

To validate whether articles referring to air pollution were regarding vehicle air pollution, industrial air pollution, or relevant to both, we sampled the articles for saliency of each issue. We coded six years in 5-year intervals, from 1980-2005, of articles that did not only contain the search term but for which air pollution was the central topic. For each article, we determined whether its central issue was vehicle air pollution, industrial air pollution, air pollution in general, or improvement in the state of air pollution. The sample size was 156 articles. 58% of titles were related to air pollution in general, 22% to vehicle air pollution, 19% to industrial air pollution and only 2% described a satisfactory air pollution condition in the country[10]. The data breakdown is available in appendix III. The results showed that signal strength for both issues was of similar magnitude. They also showed that a rise in the number of articles meant higher issue saliency as a problem-issue, rather than saliency due to issue improvement.

The intensity of institutional friction was assessed through a qualitative examination of relevant organised interests and how they impact the four types of costs outlined by Jones and Baumgartner (2005a): decision costs, transaction costs, information costs, and cognitive costs. We extended the definition of institutional costs to include the impact that organized interests can have on increasing the severity of costs associated with institutional friction. Organized interests opposed to policy change in a certain direction can be expected to add to decision costs, in particular bargaining costs, as they countermobilize to protect their interests (Jacob and Weaver 2015). In addition, organized interests may add to information costs by selectively exposing information in accordance with their interests; they may add to transaction costs by obstructing or stalling implementation. Finally, they may add to cognitive costs as dealing with private interests may require the involvement of high-level decision makers.

A timeline of policy changes for each case was constructed using various data sources. We defined policy change as any change related to one of the three issues under study, made on behalf of a government unit that had an actual manifestation, hence excluding mere declarations. We also excluded small adjustments in policy such as applying a policy tool in a slightly different manner. The Road Safety policy change list is presented in appendix I and the air pollution policy change list for both issues is presented in appendix II. Policy change included changes in regulation, in bureaucratic structure, significant budget changes, treatment of new policy areas, application of new policy tools, changes in intensity of enforcement, and policy

[10] Another 3% concerned air pollution from the energy sector.

research projects. For road safety, data was collected from government reports published since the 1950s. 68 government reports were reviewed. Short reviews of 1-20 pages were fully reviewed, for longer ones the executive summary was reviewed (from about the mid-1970s onwards). For vehicle and industrial air pollution, data was collected from three main sources: (1) Alon Tal's books (2002, 2006) on environmental policy in Israel since the country's establishment; (2) articles mentioning relevant air pollution policy changes in *Yedioth Ahronot*h from 1948-2007; and (3) such articles from *Haaretz's* article database that covers 2002-2007. We used newspaper coverage rather than government reports and documents as the latter are not available in this policy field in Israel. Triangulating between these three authoritative sources ensured that all significant policy changes were coded in our dataset, despite the deficit in government documents.

Results

Case Descriptions

Both cases display gradually progressing standards that are unidirectional. However, the cases differ in the intensity of change (see appendix I and II for policy changes data). In the case of road safety policy, the institutional structure started to significantly evolve in the 1960's, increasing in size and in budget every couple of years. This included the establishment of an academic government-funded research center in 1965 and extensive financial support allotted to a non-government organization responsible for civil involvement since the 1950s. In addition, standards were constantly improved in various aspects of road safety. Other impressive aspects are collaboration with international experts as early as 1965, policy analyses that included international comparisons since 1977 and cost-benefit analyses since 1982. The latter gradually advanced in their sophistication and in 1998 the government program for road safety included definite quantitative goals based on extensive cost-benefit analyses including measures for success. Such relatively advanced policy tools are not widely used in the Israeli government. In contrast, air pollution progressed at a slower and more constrained rate. Although an initial air pollution law was enacted in 1962, attempts at implementation repeatedly failed. Until the 1990s most air pollution policy changes were focused on responding to crises or cases of exposure to extreme levels of pollution (see policy change descriptions in appendix II). From the mid-1990s, standards for air pollution were regularly updated for vehicles, closing the gap with European

standards in the following decade. However, standards for industrial air pollution were updated in an irregular fashion without closing the gap with European countries[11].

Institutional Friction Assessment

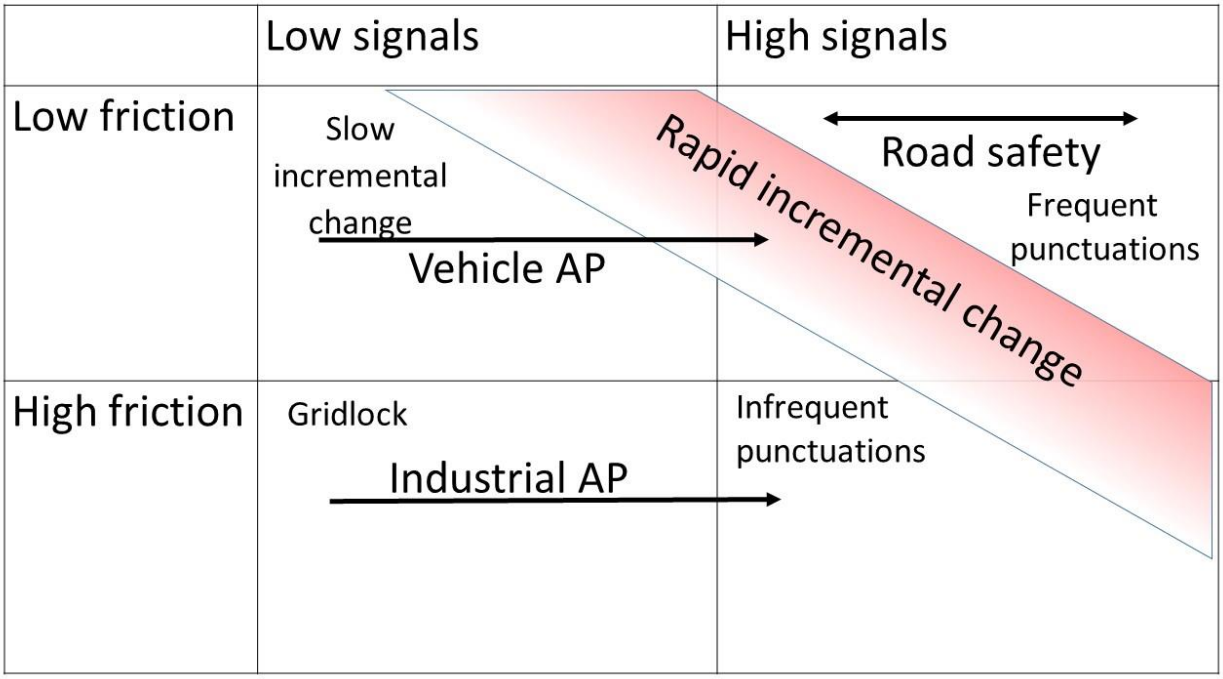
All three cases were assessed to have some level of institutional friction according to the four types of costs outlined above (see Figure 2). However, the key difference in the level of institutional friction amongst the cases stemmed from the impact on institutional costs of strong private sector organized interests counteracting change. In this context, road safety was identified as a valence issue (Baumgartner and Jones, 1993:150) for which there were no clear organized interests countermobilizing against policy change. For valence issues, opposing positions differ in their proposed solutions rather than in their conceptions of the problem (ibid). As a valence issue, institutional friction for road safety was estimated as low.

In contrast to road safety, tightening industrial air pollution standards is expected to have negative financial consequences for factories and industrial plants and their owners, some of which have a strong position in the national economy. Negative consequences for private sector organizations may in turn negatively impact the job market and the national economy. Such circumstances impact all four types of institutional friction costs described in DIP (Jones and Baumgartner 2005). Setting more stringent standards for factories and industrial plants includes separate negotiations with each organization. In addition, factories' specific characteristics including financial capacities need to be taken into account. This process adds to both decision-making costs and information costs. Factories may stall implementation or carry it out partially, for example, a recent report on random MEP checks found that from 2000, when random checks were introduced, until 2007, about 50% of factories polluted above permitted levels (MEP 2015). This adds to transaction costs. Finally, the complex process which sometimes involves the interests of strong private sector players may add to cognitive costs as it necessitates increased involvement of high-level decision makers in the policymaking process. Hence, we assessed institutional friction for industrial air pollution as high.

[11] Koren, Ora. 2007, "How Israeli Industry Changed Direction: High Fines and Publicized Sentencing Caused Polluting Factories to Change Direction," *Haaretz*. 8 August, 2007. Available at: http://www.themarker.com/consumer/1.453622 (accessed 10 August 2016). [In Hebrew]

Setting more stringent standards for vehicle air pollution has some negative consequences for private sector organizations such as bus companies and road transport companies; however, in countries with no car-producing companies policies usually do not require large investments on behalf of the private sector as they generally concern improving maintenance and purchasing cleaner vehicles in future. In addition, some private sector players such as vehicle importers pushed for local improvements that would allow for the import of more advanced vehicle models[12]. Costs for vehicle air pollution largely concern organizational adjustment rather than large private sector investments, as costs are usually shared by a multitude of vehicle owners as are the benefits of cleaner air quality. However, changing vehicle standards does require inter-governmental collaboration and negotiations with other stakeholders. Hence, institutional friction for vehicle air pollution policy was assessed in the low-moderate region.

Figure 2. Signal and Friction Levels over Time in the Three Cases



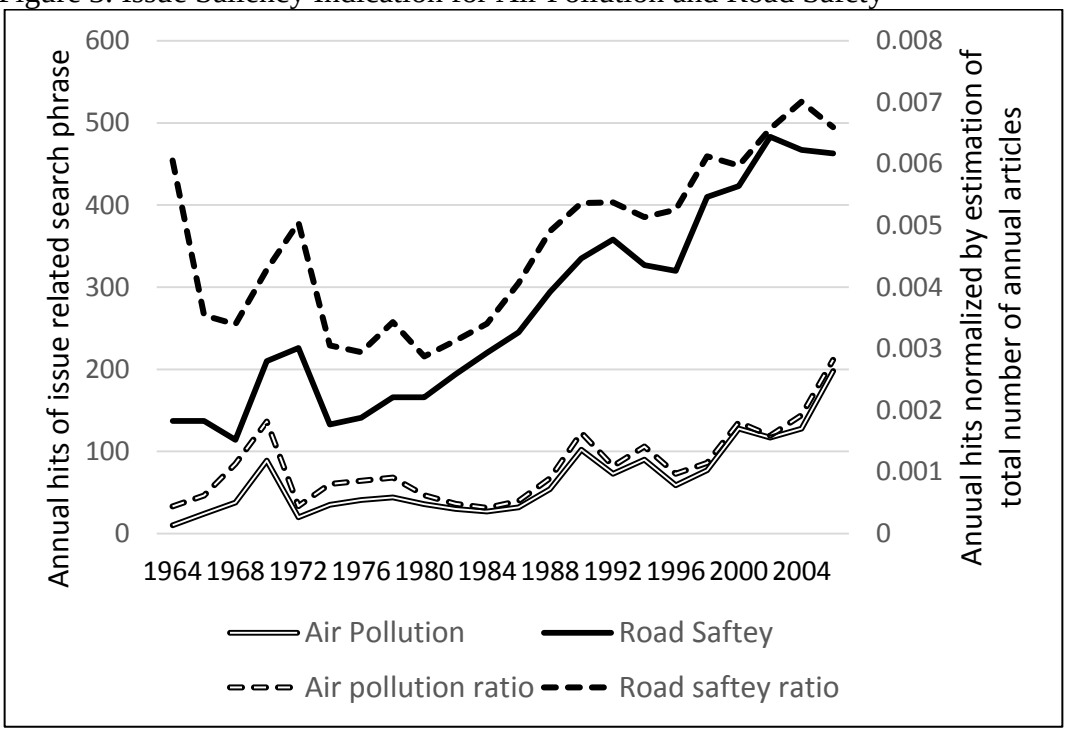
Issue Saliency

Issue saliency was found to be much higher for road safety than for either vehicle air pollution or industrial air pollution (see Figure 3). Normalized saliency was calculated by dividing the number of annual hits for key search terms by the estimation of total number of annual articles

[12] Barak, Benny, Dubi Zakai, Norit Palter, and Shalom Bar Talח "And you are choking*," Yedioth Aharanoth: Money Magazine Extra*, 21 August 2001. [In Hebrew]

(the data is presented in appendix III). The saliency for both air pollution issues rose consistently over time, from the 1960s to the 2000s. For all cases there was a short post-1967 rise in saliency as the public agenda was probably shifted from security issues during the post 1967-Six Day War national euphoria. This rise levelled in 1973 following the Yom Kippur war. In the 2000s, the air pollution issues' normalized saliency levels reached the level of road safety saliency at its weakest point following the Yom Kippur war. Based on these results issue saliency was assessed as follows: road safety had medium to high issue saliency over the entire period under study; air pollution issues both followed a similar trajectory, starting with low saliency in the 1980s, slowly rising in the 1990s and ending up with moderate saliency in the 2000s.

Figure 3. Issue Saliency Indication for Air Pollution and Road Safety



Policy Change Timelines

The road safety timeline included 170 policy changes (see Figure 4). These included 22 structural changes in a positive direction such as developing a road safety unit and establishing additional supporting units such as a government funded research center at the Technion, Israel's leading technological institute. It also included eight large-scale policy plans and only three negative changes. The pattern advancement of policy over time was disproportional: There were seven occasions where bursts of policy change occurred either in unison or immediately

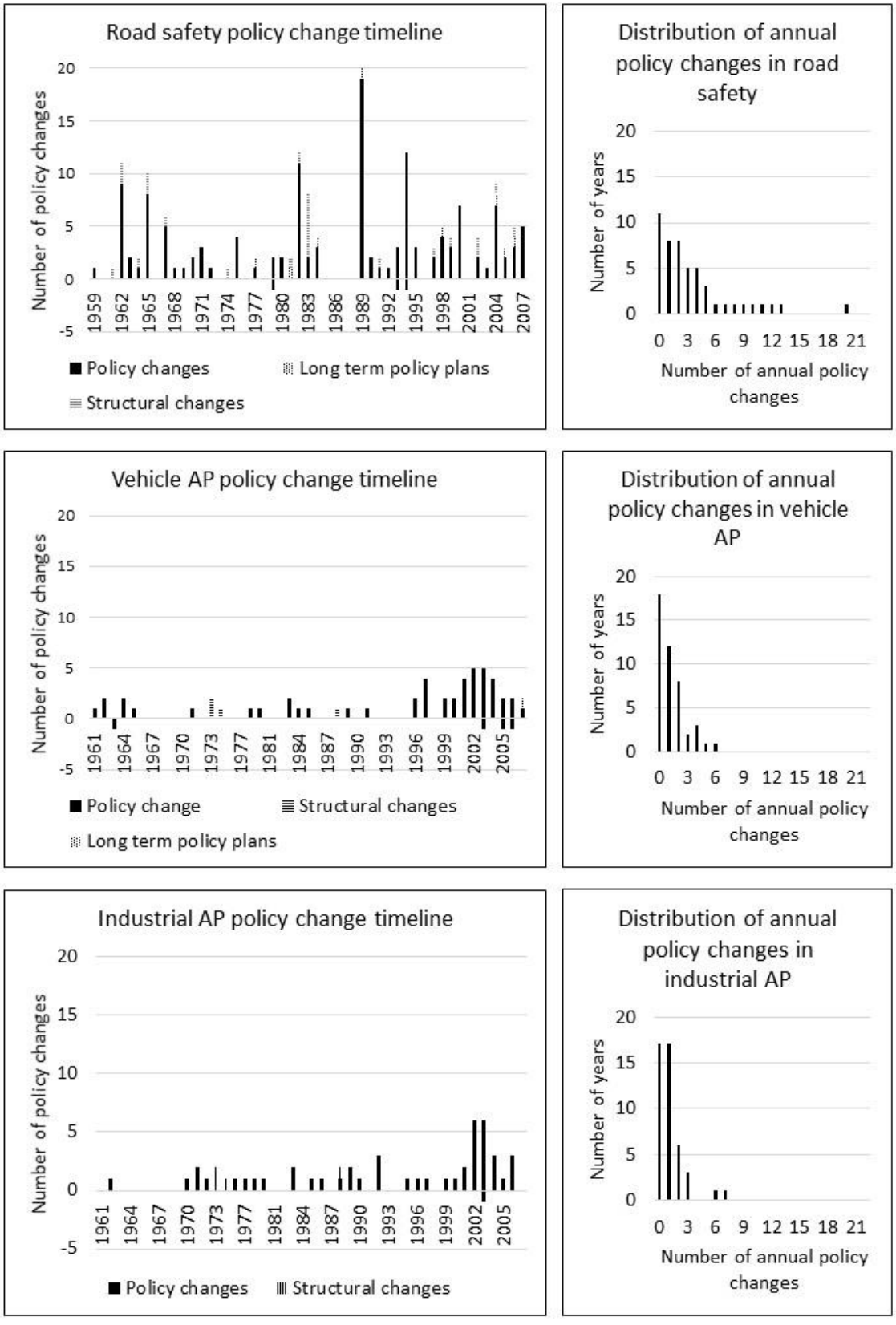
following structural change. Policy bursts occurred in 1962, 1965, 1967[13], 1982-3, 1989, 1994, 1999-2000, and a relatively long period of moderate intensity, in terms of number of changes, from 2002-2007. The 1970s was the only decade without a punctuation, likely accounted for by the national crisis atmosphere following the Yom Kippur war. The distribution of policy changes per year (see Figure 4) displayed this disproportionality in the extreme tails that represent the years in which policy change bursts occurred. In these distributions, the number of policy changes per year serves as an indication of total annual change. These results are in line with our expectation for a frequent punctuations pattern.

The industrial and vehicle air pollution policy change timelines were much more modest in terms of change intensity than road safety policy (see Figure 4). Each had 46 changes including four common structural changes, which concerned the growth of the government's air pollution unit and the establishment of a pollution research center at Tel-Aviv University. Almost all changes were in the direction of increased environmental standards. Both industrial and vehicle air pollution displayed a similar change pattern. Until the end of the 1990s, they displayed infrequent and usually isolated changes, with rising intensity in the late 1990s. Over four decades the average number of positive policy changes was about one per year for both issues. These patterns seem to fit both gridlock and slow incremental change patterns and are in line with our expectations. One reason for this could be the low signals level, which started to rise at the end of the 1980s, generating little drive for change regardless of the level of friction. During this period, only severe situations received governmental attention, such as "smoking" diesel vehicles on the roads, or industrial pollution that explicitly affected the lives of nearby residents on a daily basis. In any case we note that differentiating between the two patterns is difficult as they display much similarity.

In the new millennium, more consecutive policy changes were generated with an average of approximately three per year. In both cases, a policy sequence seems to have emerged in the form of a series of small to medium policy changes that accumulated to more significant change over time. These results seem to contradict our expectations as such a pattern should have first occurred in the case of vehicle air pollution. However, a closer examination of these policy

[13] Although there were only seven changes in 1967, 3 of these changes were quite significant including the establishment of the administration for road safety, and regulations concerning seat belts and helmets.

Figure 4. Policy Change Timelines



changes discussed in the following section revealed a significant difference between the two patterns.

Periods of More Proportional Change

The policy change patterns of the three cases were for the most part in line with a general disproportional PE pattern. From 1960-2000 the road safety case displayed relatively frequent bursts of rapid intensive change within a more or less stable routine, and the vehicle and industrial air pollution cases displayed long periods of little change. These patterns are also evident in the distribution of annual changes (see the right column of graphs in Figure 4). In these distributions, the number of policy changes per year serves as an indication of total annual change. The exceptions in the timelines are the period of 2002-2007 in the road safety case and 1996-2007 in the air pollution cases.

With regard to the period of 2002-2007 in road safety, policy changes seem to advance in a more moderate and continuous pattern, which diverges from the expected frequent punctuation pattern. Our explanation for this resides in extraordinary and turbulent conditions that characterized this period, which on the one hand pressed for significant change and on the other hand restrained major changes. During this period several distinguished committees were setup one following the other, with each producing sets of concrete recommendations for advancing policy (see appendix I). On the other hand, these recommendations included the establishment of an independent national authority for road safety, which led in turn to structural uncertainty. Eventually the authority was established in 2006 with the passage of the National Authority for Road Safety law. We postulate that this structural uncertainty may have limited sharp changes from occurring and hence changes were significant though dispersed. In any case, this period does not disprove the general pattern of frequent punctuations found for four consecutive decades.

With regard to the period of 1996-2007 in the air pollution cases, policy changes in both cases also seemed to advance in a more moderate, continuous pattern which negates our expectations concerning the effect of the different levels of institutional friction in the cases. In order to better assess the changes overall significance in each case we carried out a content analysis. For each policy change, we determined whether it was type I which we defined as improvement of standards or promoting cleaner technologies or type II which we defined as related to institutional friction costs as described by Jones and Baumgartner (2005a). Type II

included policy changes related to decision making costs such as the establishment of committees; policy changes related to transaction costs such as strengthening enforcement; and policy changes related to information costs such as conducting research. For vehicle air pollution, 61% of policy changes were type I and 39% were type II (19:12 respectively). In contrast, for industrial air pollution, only 26% of policy changes were type I and 74% were type II (6:17 policy changes respectively). Hence, while both cases displayed a concentration of non-major changes in the period analysed, vehicle air pollution policy was narrowing the gap with more economically developed country (MEDC) standards in terms of fuel and engine standards as well as other supportive policy measures, while industrial air pollution policy mostly concerned gradually intensifying enforcement of retrograde standards compared to MEDC standards, and investment in research assessing the severity of the situation[14]. In terms of our theoretical framework the case of vehicle air pollution displayed a rapid incremental pattern, gradually closing the gap with developed EU countries while the industrial case displayed only incremental progression in line with the expected infrequent punctuations pattern. We term the latter case as a weak or pseudo-sequence, as what seems to be a concentration of incremental change, on closer examination is revealed to be actually a gridlock situation in which government policy is constrained by friction.

Discussion

The policy change patterns of the three cases were for the most part in line with a general disproportional PE pattern. From 1960-2000 the road safety case displayed relatively frequent bursts of rapid intensive change within a more or less stable routine of little change in between punctuations, and the vehicle and industrial air pollution cases displayed long periods of little change. These patterns were also evident in the distribution of annual changes as shown in Figure 4. The periods of more proportional change in the air pollution cases were also in line with our expectations. As signal intensity rose vehicle air pollution entered a phase of rapid incremental change while industrial air pollution lagged behind. The period of 2002-2007 in the road safety case may be explained by structural turbulence and in any case does not negate the general frequent punctuations pattern that characterises the case.

[14] Koren, Ora. 2007, "How Israeli Industry Changed Direction: High Fines and Publicized Sentencing Caused Polluting Factories to Change Direction," *Haaretz*. 8 August, 2007. Available at: http://www.themarker.com/consumer/1.453622 (accessed 10 August 2016). [In Hebrew]

Our expectations outlined in Hypothesis One were generally confirmed. Road safety, positioned in the high signals-low friction quadrant, displayed a frequent punctuations pattern. The air pollution cases positioned initially in low signals quadrants as expected showed very little change. With regard to Hypothesis Two, results showed that from a certain level of signal strength vehicle air pollution did display a pattern of rapid, accumulating and proportional policy change. In the case of industrial air pollution policy, whilst issue saliency rose in a similar manner to vehicle air pollution policy, the high level of institutional friction restrained change and a proportional pattern of gradual, accumulating change did not emerge.

Conclusion

This study examined the impact of both signal strength and institutional friction on policy change patterns that generally progress in a certain policy direction over time. We hypothesized that the interplay of signal strength and institutional friction would have an impact on policy change patterns generating four archetypal patterns: slow incremental change, gridlock, frequent punctuations and infrequent punctuations (see Figure 1). In addition, we hypothesized that there may be a range at which the gap between level of signal strength and institutional friction creates the conditions under which gradual, accumulating change can occur with a relatively proportional pattern.

Our findings show that signal strength and institutional friction levels impact policy change patterns. The general impact of both these factors on policy change patterns has been theorized by other scholars (Jones and Baumgartner 2005a), however a comprehensive examination of the impact of different intensities of these two factors on policy change patterns has not, to our knowledge, been previously attempted. Further study is needed to replicate these findings across a broader range of countries and policy areas, and to further investigate the mechanisms by which different intensities of signals and institutional friction impact policy change patterns.

The possibility of gradual accumulating change has implications for several theories of policy process such as MS, ACF and PE. These theories focus on factors and conditions enabling major changes. Yet, they do not specify conditions for significant gradual change. Specifically, we suggest refining DIP theory to include the possibility that when signals point in a certain policy direction over a long period of time and there is a certain gap between signal strength and

the level of institutional friction, with the former strong enough to drive non-major changes and the latter weak enough to allow for accumulation over time, then a pattern of more proportional gradually accumulating change may emerge. This initial finding opens up possibilities for future policy change research directions. Further research on additional cases in needed in order to confirm the validity of the suggested refinement.

Finally the meso-level analysis has proved productive for improving our understanding of macro level findings, in particular for reconciling conflicting findings concerning policy change patterns. However, further application and methodological refinement is clearly warranted.

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Appendix I: Road Safety Policy Changes Data

Table 1. Policy Change Descriptions

Year	**Policy changes description** * = estimated date[15] S = structural P = large scale policy plans N=negative	**Policy change count** (particulars)	**Source**
<1959	1. Formation of the unit for accident prevention. (S) 2. Formation of the council for accident prevention providing guidance and instruction. (S)	2(2S)	6
1959	1. Following the Salomon committee the government forms an inter-ministry committee for accident prevention	1	6
1960		0	
1961	1. Formation of the fund for accident prevention and its initial actions. (S)	1(1S)	3
1962	1. Vehicle inspections initiated during license renewal. 2. Quality inspection of vehicles and parts at the manufacturers. 3. Courses organized for safety officers in companies with large vehicle fleets and for public transport organizers. 4. Publication of driving rules and orders. 5. Formation of a joint (Health and Transport Ministries) institute dealing with licensing to physically impaired people.* (S) 6. School children safety troops are formed. * 7. Danger spot research.* 8. Drivers instructional project. * 9. Organization of traffic observers formed. * (S) 10. Instructional programs directed at cyclists. * 11. Instructional programs directed at pedestrians. *	11(2S)	29, 3
1963	1. Instructional program to promote safety belt usage. 2. Instructional program to promote crash helmet usage for motorcyclists.	2	3
1964	1. Formation of road safety administration. * (S) 2. First instructional program on winter driving.	2(1S)	8,7
1965	1. Implementation of filing system to keep track of drivers with repeat violations. 2. System of standards and engineering criterions established. 3. First academic study completed. 4. Road Safety Department formed in the transport inspector's office. (S) 5. Vehicles marked with shiny reflecting tapes and red triangular reflectors set up behind stranded vehicles.	10(2S)	7, 7b

[15] When a new policy measure was described as occurring for several years, its date was set as pervious year to the year of the report.

	6. Road safety center established in the Technion to gather and direct relevant research. 7. Instructional directives on winter vehicle preparation. (S) 8. Road safety radio programs opened. 9. International experts invited. 10. Increased punishments for hit and run drivers.		
1966			
1967	1. Road safety board established. (S) 2. Safety helmets made compulsory. 3. Safety belts made compulsory. 4. Educational conferences in Arabic for drivers in the new territories. 5. Safe driving educational program established in new territories. 6. Traffic laws booklets distributed to most vehicle owners.	6 (1S)	9, 24
1968	1. Negative point system established for traffic violators.	1	2, 5, 6, 9
1969	1. Survey on methods dealing with road safety problems in other countries.	1	36
1970	1. Agreement with Ministry of Finance on increase budget for multiyear program to increase road safety. 2. Focused effort on engineering projects to increase road safety in local authority areas.	2	27
1971	1. Implementation of safety rules for professional drivers. 2.Price reduction of vehicle spare parts that increase safety 3. Safety patrols established in cities.	3	12
1972	1. Preparation for a road communication system for fast evacuation of accident victims.	1	12
1973		0	
1974	1. Formation of National Road Safety Board. (S)	1 (1S)	10
1975	1. Plans to form a permanent Knesset subcommittee to deal with road safety. 2. Appointment of road safety supervisors in local authorities. 3. Update and completion of guidelines for road infrastructure and safety fittings. 4. Reduction of taxes on spare parts related to road safety.	4	13, 3, 21
1976			
1977	1. First comprehensive 100 page report including an in depth review on the subject including international comparisons. (P) 2. Al-Nir Committee formed to raise safety standards in local authority areas.	2 (1P)	33, 35
1978			
1979	1. Work of road safety board temporarily suspended. (N) 2. Decision to invest in one "model road safety city". 3. Shiny reflectors distributed to pedestrians.	3 (1N)	13

1980	1. Fund for prevention of road accidents established. 2. Compulsory use of helmets for motorcyclists first mentioned in regulations.	2	30, 38
1981	1. Formation of Road Safety Administration (RSA) headed by Moshe Amirav. (S) 2. RSA prepares an extensive work plan. (P)	2 (1S, 1P)	37,16
1982	1. RSA launches initiatives in legislation, enforcement, infrastructure, and vehicle and driver safety. 2. Road safety work plan adopted by all governmental bodies. 3. First assessment of economic damage caused by road accidents. 4. Road safety projects doubled. 5. Road safety projects for children tripled. 6. 70% increase in road safety budgets. 7. RSA cooperates with police and thousands of policemen put on road patrol. 8. RSA initiates a safety patrol unit. 9. A unit for road vehicle inspection is formed. (S) 10. First conferences of mayors with their engineers. 11. First driver's alcohol tests. 12. Annual work plans laid out (not just activity summaries).	12 (1S)	17, 30, 37, 38
1983	1. Safety infrastructure budgets doubled for municipalities with emphasis on "accident prone" spots. 2. Computerized information system set up for RSA. 3. Mobile units formed for vehicle inspection. (S) 4. Gush Dan metropolitan framework formed for infrastructure improvement.(S) 5. Special courts formed for accelerated jurisdiction. (S) 6. Road safety units formed as part of the civil national guard. (S) 7. Traffic Police Unit formed. (S) 8. Ministers Committee for Road Safety formed. * (S)	8 (6S)	39, 21
1984	1. First five year master plan formed (length hundreds of pages). (P) 2. First national goal defined (7 deaths per 100000 people). 3. First definition of "red" roads and their concentrated improvement. 4. Gradual expansion of the road safety educational system.	4 (1P)	18, 30, 40, 43
1985		0	
1986		0	
1987		0	
1988		0	
1989	1. Taxes cancelled on vehicle safety parts. 2. Old vehicles require two licensing tests a year 3. Garage managers must report unsafe vehicles that are not fixed by their owners.	20 (1P)	22, 30, 42, 44

	4. Light reflecting license plates installed. 5. Buses and vehicles above 15 tons require ABS systems. 6. Buses and trucks require tachograph installation. 7. Motorcyclists under 18 with engines under 50cc forbidden to carry passenger. 8. Driving license renewal changed from annual to bi-annual. 9. New drivers required to attach "new driver" sign. 10. Children under 4 require backseat safety harness. 11. Minimal "distance time" set to one second allowing for enforcement of minimal distance between cars law. 12. Parental agreement required for under 17 50cc motorcycle licensing. 13. Sticker labeling required after annual vehicle license renewal test. 14. Road safety officer employment regulations reinforced. 15. Motor vehicles tax reduction. 16. License cancellation for drug and alcohol abusing drivers. 17. Official specifications for slow down bumpers. 18. Five year (1990-95) road safety plan approved. (P) 19. Joint committee of Transportation, Finance and Housing ministries formed to discuss ways to improve urban and interurban road infrastructure		
1990	1. Driving restrictions on drivers under 18 after 1 a.m. 2. Significant expansion of the number of municipal road safety staff.	2	44, 45
1991	1. National traffic police mobilized 2. Winter day headlight activation imposed on trucks, buses taxis and motorcycles.	2 (1S)	30, 49
1992	1. Extension of traffic police patrols to the south Israel up to Eilat.	1	30, 45
1993	1. Winter day headlight activation imposed on all vehicles. 2. Speed limit in 3 road sections increased from 90Km/h to 100Km/h. (N) 3. Minimum age for driver's licenses increased to 17.5. 4. Beeper sounding while reversing installed in heavy vehicles.	4 (1N)	30, 49, 50
1994	1. Safety belts compulsory in back seats of vans and minibuses. 2. Alcohol breath test and blood tests approved as court evidence. 3. Car drivers allowed to obtain 50cc motorcycle license by passing test (no course). (N) 4. Heavy motorcycle licensing above age 24 (reported in 1989 but approved 1994). 5. Definition of accident prone interurban roads on an annual basis.	13 (1N)	30, 50, 52, 53

	6. Joint research of Finance Ministry and the National Roads Company on establishing standards for estimating economic value of road accidents. 7. Compulsory Road safety education in high schools. 8. Speed limit increased to 110Km/h on fast highways. 9. Mobile phone usage while driving prohibited unless hands-off mike installed. 10. Mini tractors not allowed on roads. 11. New immigrants required to pass driver's license tests. 12. Trauma centers established in 5 major hospitals. 13. Planning the conversion the Road Safety Administration into an independent National Road Safety Authority.		
1995	1. Device limiting speed to 90 km/h installed in all trucks and buses from 96 models and later. 2. Drivers made responsible for safety belt use. 3. License suspension for drunk drivers set at a minimum of 2 years.	3	30
1996			
1997	1. National road safety law approved. 2. Formation of a non-independent road safety authority inside the Transportation Ministry. (S) 3. Truck drivers required to attend training course and test.	3 (1S)	
1998	1. Three year road safety program prepared. (P) 2. First general program launched including definite quantitative goals with detailed cost effective calculations with success and control indices. 3. The government approves the above program. 4. Substantial budget increase. 5. Automatic enforcement increased by 30% from January 98.	5 (1P)	1
1999	1. New drivers require accompaniment for the first 2 months. 2. Obligatory road safety committees formed in city councils. 3. Transport prosecution system separated from criminal prosecution and begins to function independently. (S) 4. Intensive publicity program on safety belt usage and handling of traffic offences.	4 (1S)	30, 54, 55, 57, 58
2000	1. State Comptroller road safety report published. 2. Safe City Project. 3. Effort concentrated on a few subjects including avoiding head-on and side-on collisions, excess speed and changing driving culture. 4. Some changes in headlight regulations for motorcycles, buses and vehicles less than 15 tons. 5. New regulations regarding excess weight. 6. Changes in licensing of post-accident vehicles.	7	

	7. New system to minimize time from offense photo recording to report delivery to offender.		
2001			
2002	1. Appointment of parliamentary investigative committee on road safety. (s) 2. Point system implemented for traffic offenses with correction tracks and license suspension. 3. Formation of directive team with professional support and public figures to create a multi-year strategic operative and effective program to increase road safety. (S) 4. Public committee appointed to review road haulage.	4 (2S)	5, 30, 58, 59, 60
2003		1	
2004	1. Changes in rules for new drivers regarding accompanying person, period of accompaniment and number of passengers. (S) 2. Safety seats required for children. 3. Termination of reorganization of RSA structure. 4. Appointment of team of experts headed by Dr. Sheinin to prepare a national multi –year road safety program. (P) 5. Road safety education made compulsory for 11th graders. 6. First call for universities and industries to propose applied research. programs on road safety 7. Beginning of project A-3 designed to place 300 speed monitoring cameras. 8. Third generation of safety devices approved by the inter-ministerial committee including safety barriers, shock absorbers and flashing reflectors. 9. Safety profile established for local authorities as a basis for improvement.	9 (1S, 1P)	30, 63
2005	1. Sheinin committee report: presents multi –year program to increase road safety at least to the point of cost effectiveness. (P) 2. More stringent measures against drunk driving. 3. Usage of earphones while driving prohibited.	3 (1P)	30, 64
2006	1. Government adopts Sheinin report. (P) 2. Knesset implements National Authority for Road Safety law. 3. Formation of National Authority for Road Safety. (S) 4. Small battery operated vehicles prohibited from road travel. 5. Compulsory usage of reflective vest on inter urban roads.	5 (1S, 1P)	30, 65, 66
2007	1. More stringent enforcement of child safety seating. 2. More stringent enforcement regarding phone usage while driving. 3. Driver display screen prohibited. 4. Speed restriction to 30 Km/h on certain urban roads. 5. Traffic offense point system reinforced.	5	30
Total		170 (23S;8P;3N)	

Table 2. Road Safety Policy Change Data Summary

Year	Regular policy changes	Structural changes	Large scale policy plans	Negative policy changes	Annual total
1959	1				1
1960					0
1961		1			1
1962	9	2			11
1963	2				2
1964	1	1			2
1965	8	2			10
1966					0
1967	5	1			6
1968	1				1
1969	1				1
1970	2				2
1971	3				3
1972	1				1
1973					0
1974		1			1
1975	4				4
1976					0
1977	1		1		2
1978					0
1979	2			1	3
1980	2				2
1981		1	1		2
1982	11	1			12
1983	2	6			8
1984	3		1		4
1985					0
1986					0
1987					0
1988					0
1989	19		1		20
1990	2				2
1991	1	1			2
1992	1				1
1993	3			1	4
1994	12			1	13
1995	3				3
1996					0
1997	2	1			3
1998	4		1		5
1999	3	1			4
2000	7				7

2001					0
2002	2	2			4
2003	1				1
2004	7	1	1		9
2005	2		1		3
2006	3	1	1		5
2007	5				5
total changes	136	23	8	3	170

Table 3. Source Data

Source #	**Authors** MOT= Ministry of Transport RSA= Road Safety Administration INRSA= Israel National Road Safety Authority	**Year**	**Title**	**Place** **J**= Jerusalem	**Publisher**
1	MOT	1999	Annual report and outline of 2000 work plan 1999	J	MOT
2	MOT	1997	1997work plan for	J	MOT
3	MOT	1964	The transport economy1963/64 (Transport minister I. Bar Yehuda 1964)	J	MOT
4	MOT	1958	Transport in Israel: Facts and Trends	J	MOT
5	MOT	1959	Transport in Israel	J	MOT
6	MOT	1960	Transport economy in Israel	J	MOT
7	MOT	1965	Transport .1964/5	J	MOT
7b	MOT	1966	Transport.1965/6	J	MOT
8	MOT	1966	Transport Ministry	J	MOT
9	MOT	1968	Transport	J	MOT
10	MOT, Dept. of planning and economics	1977	Transport development policy in Israel1975-1979-1985 : part 6 road safety	J	MOT
11	MOT	1971	Transports and freights: milestones in transport development in Israel	J	MOT
12	MOT	1972	Israel 17:transport	J	MOT
13	MOT	1979	Milestones: Ministry of Transport bulletin	J	MOT
14	MOT	1980	Milestones: Ministry of Transport bulletin	J	MOT

15	MOT	1980	Milestones: Ministry of Transport bulletin	J	MOT
16	MOT	1981	Milestones: Ministry of Transport bulletin	J	MOT
17	MOT	1983	Milestones: Ministry of Transport bulletin	J	MOT
21	MOT	1983	Milestones: Ministry of Transport bulletin	J	MOT
18	MOT	1984	Milestones: Ministry of Transport bulletin	J	MOT
19	MOT, RSA	1992	Data on road accident prevention measures	J	MOT
20	MOT, RSA	1971	April- November 1971 progress report according to 1971/72 work schedule	J	MOT
22	MOT, RSA	1991	Efforts to increase road safety	J	MOT
23	Moshe Orion	1957	Road accidents in Israel	J	MOT
24	MOT	1967	Opening address of Transport Minister Moshe Carmel at the 1967/8 budget deliberation	J	MOT
25	MOT	1968	Opening address of Transport Minister Moshe Carmel at the 1968/9 deliberation budget	J	MOT
26	MOT	1969	Opening address of Transport Minister Moshe Carmel at the 1969/70 budget deliberation	J	MOT
27	MOT	1970	Opening address of Transport Minister Ezer Weizman at the 1970/71 budget deliberation	J	MOT
28	MOT	1971	Opening address of Transport Minister Shimon Peres at the 1971/72 budget deliberation	J	MOT
29	MOT	1962	Opening address of Transport Minister I. Bar Yehuda at the 1962/3 budget deliberation	J	MOT
30	V.Gitelman E.Duba L.Hendel S.Behor	2010	Assessment of safety intervention effect on the number of traffic accident casualties	J	Technion Institute for Transport Research
31	MOT	1973	Review of Ministry of Transport activities for 1973 fiscal year	J	MOT
32	MOT	1975	Minister of transport's review of his office's activities in parliamentary discussion on the 1975 fiscal year Ministry of Transport budget	J	MOT

33	MOT, Dept. of Planning and Economics	1985	Transport development policy-1979-1985	J	MOT
34	MOT	1977	Minister of Transport's review on main developments and activities in years 1974-77	J	MOT
35	MOT	1977	Minister of Transport's review of his office's activities during the Knesset's debate on the 1977 budget	J	MOT
36	MOT, RSA	1969	Governance, dealing with road safety	J	MOT
37	MOT, RSA	1982	Work plan	J	MOT
38	MOT, RSA	1982	Policy and undertakings of the Road Safety Administration	J	MOT
39	MOT	1983	Minister of Transport's review of his office's activities during the Knesset's 1983 Budget deliberations	J	MOT
40	MOT	1984	Minister of Transport's review of his office's activities during the Knesset's the 1984 budget Deliberations	J	MOT
41	MOT	1985	Minister of Transport's review of his office's activities during the Knesset's 1985 budget deliberations	J	MOT
42	MOT	1988	Minister of Transport's review of his office's activities during the Knesset's 1988/9 budget deliberations	J	MOT
43	MOT	1989	Minister of Transport Moshe Katsav's review on his office's activities	J	MOT
44	MOT	1991	Review of the Ministry's activities during 91 fiscal year	J	MOT
45	MOT, RSA	1993	The campaign to increase road safety	J	MOT
46	MOT, RSA	1984	Multi-year road safety plan	J	MOT
47	MOT, RSA	1989	Multi-year road safety plan 1990-95	J	MOT
48	MOT	1993	1993 work schedule	J	MOT
49	MOT	1993	Minister of Transport's review of his office's activities during the Knesset's 1993 budget deliberations	J	MOT

50	MOT	1994	Minister of Transport's review of his office's activities during the Knesset's 1994 budget deliberations	J	MOT
51	MOT	1980	Review of the Ministry's activities during 1980 fiscal year	J	MOT
52	MOT, RSA	1994	Road safety education	J	MOT
53	MOT	1994	1994 work plan – main points	J	MOT
54	INRSA	1999	Multiyear road safety plan 1999-2001	J	MOT
55	INRSA	1999	1999 activity summary	J	MOT
56	INRSA	2000	Response to The State Comptroller’s report on road safety	J	MOT
57	INRSA	1999	1999 report and 2000 work plan	J	MOT
58	INRSA	2000	Report for 2000 and main points for 2001 work plan	J	MOT
59	INRSA	2003	The Authority’s CEO report to the council: implementation of 2002 work plan	J	MOT
60	The Knesset	2003	Report of parliamentary investigative committee on road safety	J	The Knesset
61	INRSA	2004	Complete report on 2003 road safety work plan	J	MOT
62	INRSA	2003	Report on 2003 road safety work plan achievements and main points of 2004 work plan	J	MOT
63	INRSA	2005	Complete report on 2004 road safety work plan	J	MOT
64	The Committee for the Preparation of a National, Multi-Year Road Safety Plan	2005	Sheinin committee report: The committee for preparation of a national multi-annual road safety plan: Main points	J	MOT
65	INRSA	2006	2006 annual report	J	INRSA
66	INRSA	2005	2005 annual report	J	INRSA
67	Or Yarok	2008	Implementation of Sheinin Committee recommendations	Israel	Or Yarok
68	INRSA	2011	Trends in Israeli road safety 2001-10	J	INRSA

Appendix II: Air Pollution Policy Changes Data

Table 4. Air Pollution Policy Change Descriptions.

Year *=estimated date	**Policy changes**	**Policy change count** R=Regulation change S=Structural change P=National plan D=Decision process oriented T=Transaction oriented I=Information oriented			**Source** (D.M.Y, "(title)", (Source initial). (D.R. = Davar Rishon; H= Haartez; Y= for Yedioth Ahronoth: all Hebrew-language newspaper sources). Otherwise standard referencing
		General	Industrial	Vehicle	
1961	Anti-pollution campaign against "smoking" vehicles.			T	28.11.1961, “The Blame – Air pollution”, Y. (Tal 2002, 249-50)
1962	Kanovitz Law for prevention of air pollution, excess noise and odor.	R			28.1.1963, "Smoking vehicles fined", Y. 29.1.1963, "Polluting drivers prosecuted", Y. (Tal 2002, 249-50)
1963	Kanovitz Law alleviated.			-R	8.3.1963, "One year extension for smoking vehicles”, Y. (Tal 2002, 249-50).
1964	Kanovitz Law reformulated to enable renewed enforcement.			R	1.11.1963, "Illegal smoke becomes legal", Y. 7.5.1964, "Kanovitz Law reformulated",Y . 26.7.1964, "Kanovitz Law enforced today", Y.
1964	Formation of a committee to review implementation of the Kanovitz Law due to drivers' protest.			D	4.8.1964, "Taxi drivers prepare for last battle", Y. 14.8.1964, "Truck drivers' strike may disrupt food supply", Y. 17.8.1964, "Truckers strike almost state wide", Y. 19.8.1964, “Kanovitz Law emits black smoke and creates absurd situations", Y. 19.8.1964, "Buses will join strike", Y. 3.09.1963, "Committee appointed to investigate Kanovitz Law implementation", Y.
1965	Kanovitz Law reformulated in an effort to make it effective.			R	22.2.1965, "Kanovitz Law renovation", Y.
1971	Kanovitz Law revived in an effort to deal with smoking diesel vehicles.			R	9.3.1971. "Transport Minister decides to revive Kanovitz Law", Y.
1970	Mobile units for air pollution monitoring		I		12.11.1970, " Pollution monitoring mobile units deployed in Ramat Gan", Y.

	placed around industrial plants in Ramat Gan.				
1971	Pollution monitoring mobile unit placed at Ministry of Health plants.		I		11.4.1971, "Pollution monitoring mobile unit", Y.
1971	Regulations for prevention of Industrial pollution signed by Ministers of Health and Interior.		R		5.12.1971, "Regulations for prevention of industrial pollution signed by Ministers of Health and Interior", Y. (Tal 2002, 251)
1972	A decree for limiting air pollution was issued the Nesher cement factory		R		(Tal 2001, 1971)
1973	Environmental Health Hazards Research Institute founded.	I			21.3.1973, "Environmental health hazards research institute founded at Tel Aviv University", Y.
1973	Establishment of the Environmental Protection Service	S			(Tal 2002, 259-61)
1975	Establishment of 15 Environmental Protection Units in cities of more 80,000 residents, to solve their immediate environmental problems	S			17.2.1975, "Ecology Union of Gush Dan cities formed", Y. (Tal 2002, 268)
1976	Pollution monitoring stations founded in Haifa.		I		(Tal 2002, 268) 13.3.1976, "Pollution monitoring stations founded in Haifa", Y.
1977	Cotton plant shut down due to excessive pollution.		R		30.1.1977, "Cotton plant in the Negev shut down due to air pollution", Y.
1980	Research on industrial pollution requested by Ministry of Interior and carried out by an American investigator.		I		4.6.1980, " Most industrial plants cause air pollution", Y.
1980	Statewide air pollution survey carried out.	I			9.7.1980, "Haifa- most polluted city", Y. 26.4.1981, "Exceptionally high Pollution recorded in Tel Aviv" , Y.
1983	Kanovitz Law revised to enable	R			30.1.1983, "Kanovitz Law revision will enable offenders imprisonment", Y.

	enforcement of anti-pollution regulations.				(Tal 2002,272)
1983	"Pollution monitoring station built in PEah Tikva.	I			1.3.1983, "Pollution monitoring station built in PEah Tikva", Y.
1984	The Minister of Interior signed to personal decree to the Haifa Refineries to reduce the content of sulfur in their PEroleum.			R	(Tal 2002,1984)
1985	The Ministry of Interior sets up a national committee of experts to examine ambient air standards in Israel.	I			(Tal 2002, 289). Ministry of the Interior. 1985. "Environmental Quality in Israel". Position paper summaries for ozone, particulates, and sulfur dioxide in: Environmental Air Quality Standards, no. 11, pp.44–54.
1986	Industrial plants in Haifa required to transfer to low sulfur fuels.		R		22.10.1986, "New Pollution regulations in Haifa area", Y.
1988	Criminal charges pressed against plant managers for failing to use low sulfur fuel.		E		30.6.1988, "Refinery director warned following deviations from pollution regulations", Y.
1988	Establishment of the Ministry of Environmental Protection	S			(Tal 2002, 284-6)
1989	Fuel Administration reduces sulfur content in gasoline reducing pollution but raising its price.			R	4.4.1989 "Soon: 91 unleaded gasoline", Y. 19.6.1989, "Gasoline lead content to be reduced but price increase expected", Y.
1989	Committee appointed to examine air pollution standards following extreme pollution conditions in Haifa.		D		1.5.1989, "Sulphur dioxide cloud over Haifa", Y. 12.5.1989, "Milo: we will prosecute air polluters in Haifa", Y. 3.10.1989, "Complaints over air pollution in Haifa", Y. 5.11.1989, "Milo and Shahal to discuss pollution standards", Y. 15.12.1989, " Committee appointed to examine pollution standards ", Y.

1989	MEP closes of Castel Quarry through personal decree.		R		(Tal 2002, 288)
1990	Personal decree by MEP to Nesher cement factory in Beit Shemesh following civil protest.		R		(Tal 2002, 379-82)
1991	A gradual transition to unleaded fuel in new cars begins and is spread out over a four-year period. This occurred four to seven years after the transition in the EU, depending on vehicle type.			R	(Tal 2002, 324) Lovei, Magda. 1998. "Phasing out lead from gasoline: world wide experiences and policy implications". *World Bank Papers*. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1998/01/01/000009265_3980312111309/Rendered/PDF/multi_page.pdf (retrieved, 27.07.2016)
1992	MEP issues higher pollution standards for Electric Company and Haifa Bay refineries in 1989. The case is taken to court and standards are authorized in 1992.		R		(Tal 2002, 289-92).
1992	MEP issues higher ambient air pollution standards. The case is taken to court and standards are authorized in 1992.		R		(Tal 2002, 289-92).
1992	Decrees to operating quarries in the North.		R		(Tal 2002, 303)
1995	MEP Minister Sarid issues an order to close Haifa Refineries if they do not stop violating there decree as a result they stop their violations and use 1% Sulphur fuel year round).		R		(Tal 2002, 303) 8.12.1995, "The Oil Refineries in Haifa Will Change to Using Low Sulfur Fuel," D.R.
1996	New law enables prosecution of pollution offenders	R			24.1.1996, "New law enables prosecution of pollution offenders even without direct proof of damage", Y.

	even without direct proof of damage.				
1996	Experiment with gasoline additive to reduce bus pollution.			I	4.2.1996, " Experiment with gasoline additive to reduce bus pollution", Y.
1997	Experiment to reduce truck pollution in Tel Aviv.			I	31.3.1997, "Experiment to reduce pollution from gas operated garbage disposal truck ", Y.
1997	Five new pollution-monitoring stations built.		I		31.3.1997, "Experiment to reduce pollution from gas operated garbage disposal truck", Y.
1997	MEP publishes research on city car pollution.			I	16.6.1997, "Car pollution widespread in large cities", Y.
1997	Campaign against polluting vehicles in Tel Aviv.			T	2.9.1997, "Campaign: air polluting vehicle license to be suspended", Y.
1997	New car pollution monitoring stations in Tel Aviv.			I	29.10.1997, "Severe traffic air pollution in Tel Aviv", Y. 1.12.1997, "Air pollution increase in Tel Aviv", Y.
1998	MEP signs a convention with the factories concerning pollution standards. The standards are not updated and they are agreed to be frozen for 14 years!		R		(Tal,2006, 443-3) Tal Alon. 2006. *Natural Resources, Crises, Struggles and policy – from the beginning of Zionism to the 21 century.* Tel Aviv: The United Kibbutz
1999	General reduction of diesel fuel to 0.05% sulfur content with expected 30% reduction of pollution.			R	31.5.1999, "From today: low sulfur diesel fuel", Y.
1999	New pollution monitoring stations in Jerusalem.	I			7.9.1999, "Mountain air clear as wine? Not anymore in Jerusalem", Y.
2000	Ministry of Environment Protection begins unscheduled examinations at industrial plants.		T		Ministry of Environment Protection Air Quality Dept. 2015. “Report on unscheduled examinations of industrial plants chimneys and summary of activities 2013-2014”. (downloaded 27.7.2016).
2000	Gasoline European standard Euro 3 adopted but refineries			R	8.2.2000, "Smoke in your eyes", Y. 3.4.2000, "Octane 95 fuel to be upgraded to European standard, car import selection to be expanded", Y.

	unable to produce it (until 2001).				21.8.2001, "And you suffocate" – importers press to transfer to Euro 4", Y.
2000	Government approves: gas operated buses imports from 2001.			R	22.8.2000, "Government approves: gas operated buses imports from 2001", Y.
2001	MEP increased the number of surprise checks on air pollution emissions from factories. 133 checks were carried out (in comparison to 24 in 2000). Violations were found in more than 50% of the factories.		T		21.01.2002, "Pollution from plant that received environment quality prize, pollution offences in most examined plants", H.
2001*	MOH ordered an epidemiological study in Ramat Hovav.		I		20.03.2002, "This summer too, the stench continues", H.
2001	Knesset legislation committee approves fining traffic pollution offenders.			R	1.6.2001, "For the first time: fines for polluting cars", Y.
2001	The Ministry of Environmental Protection (MEP) issued legally binding orders to the Egged and Dan bus companies to switch to city diesel and reduce their emissions by 50% in three years by various means.			R	6.6.2001, "Legal steps against polluting buses", Y. 5.07.2001, "Hanegbi: pollution in cities-extremely heavy", Y.
2001	The Minister of Infrastructure (A. Liberman) signed an order for allowing the operation of LPGs in Israel following the decision of the Ministers' Committee for the Economy (MCE), headed by the Finance Minister (S.			R	14.1.2002, “The minister of Infrastructure signed a warrant for LPG usage”, H.

	Shalom), to promote the order.				
*2001	Egged Bus Cooperative and MEP started a catalytic converter experiment.			I	18.3.2002, “The Ministry for Environment: The Fuel Administration is delaying the transition to Low Sulfur Diesel”, H.
2002	MEP increased the number of surprise checks on air pollution emissions from factories. 242 checks were carried out (in comparison to 133 in 2001). Violations were found in more than 50% of the factories.		T		23.8.2002, "Deviations in release of toxic substances found again in Ramat Hovav", H.
2002	The Ministry of Environmental Protection (MEP) started to provide air pollution forecasts for the Tel Aviv area. It is planned that in the future such forecasts will be provided to other cities, such as Jerusalem and Haifa.	I			14.1.2002, "Soon pollution daily forecast in large cities", H.
2002	The Shafir factory, located in Tel-Aviv, will shut down on June 30th. The relocated factory was obliged to improve its fuel type.		R		14.02.2002, “The Shafir factory will soon begin clearing its area plot”, H.
2002	The MEP published a report on its 2001 surprise emission checks on factories. Out of 133 checks carried out in 57 factories, more than half of the factories deviated from their approved emission levels.		T		21.04.2002, “Deviations in air pollution in most of the factories checked”, H.

2002	The National Council for Planning and Building authorized adding liquid gas fuel pumps to gas stations in an amendment to the national plan for gas stations (TAMA 18).			R	14.5.2002, "Fuel pump operation using liquid gas fuel approved", H.
2002	MEP commenced a legal investigation against Dan Bus Company for not filling all the requisites of the order it received earlier that year.			T	26.6.2002, "Criminal investigation against Dan for breach of pollution reduction order", H.
2002	MEP decided that criminal investigation will be conducted against executives from two Ramat Hovav factories following the second round of surprise checks and against another five factories which breached their allowed pollution levels as was found in surprise inspections (see D2002-4)		T		23.8.2002, "Deviations in release of toxic substances found again in Ramat Hovav", H.
2002	The Director of the Southern District in MEP held a hearing for Ramat Hovav Local Council's chairman.		T		3.9.2002, "Demand for Ramat Hovav council to disperse due to failure to control air pollution", H.
2002	Haifa pollution data revealed. Mortality research shows that in Haifa 15% more die from cancer and lung disease related to pollution.		I		10.10.2002, "More people die in Haifa due to pollution", Y.
2002	MEP gave a legally binding directive to five large bus			R	3.11.2002, "Buses in public lines to use low Sulfur content Diesel fuel", H.

	companies to switch to low sulfur diesel and outlined conditions for emissions reductions				
2002	The government decided to create a committee for the reduction of air pollution with an emphasis on pollution in cities and pollution from vehicles. The plan was presented to the government in 2004.			D	23.10.2004, "The plan: polluting cars prohibited from entering Tel Aviv", H.
2002*	The Fuel Administration decided on a national transition to city diesel from May 2003.			R	22.4.2003, "The Technion: transferring to low sulfur diesel will save 160 Shekel per annum", H.
2003	MEP performed a third round of 86 surprise checks for factories. Of the factories checked, 60% were found to pollute in excess to their warrants. The number of checks decreased by a third in comparison to 2002.		-R		11.5.2004, "Unscheduled examinations in 2003, most plants polluted beyond allowed limits", H.
2003	Following a second fire within a week's time in the electrochemical plant near Akko, the MEP CEO set up an investigative committee.		T		3.10.2003, "Testimonies: shabby maintenance caused fire in Akko", H.
2003	MEP research shows high mortality rate due to pollution.			I	7.1.2003, "Danger in the sky", Y.
2003	The Committee for Fundamental Planning Issues authorized			R	23.1.2003, “Plan for building gas refueling stations approved", H.

	adding natural gas pumps to existing gas stations.				
2003	The Finance minister signed an order cancelling the purchase tax (19.2%) on the system for conversion of a PErol engine to a LPG.			R	10.2.2003, "Purchase tax cancelled on cars running on LPG", H.
2003	The Fuel Administration delayed the transition into city diesel from May 2003 to January 2004			-R	22.4.2003, "The Technion: transferring to low sulfur diesel will save 160 Shekel per annum", H.
2003	MEP report released on pollution deviations found on "surprise" checks in industrial plants in 2002		T		7.7.2003, "The polluters", Y. 11.5.2004, "Contaminated country", Y.
2003	The Minster of Environmental Protection declared she will set up a committee to investigate the polluting fire in the Haifa Bay Refineries. The committee recommended criminal investigation against the refinery and another factory alongside several other factory requirements to implement in order to ensure such polluting events will not occur in future.		T		15.9.2003 " Heavy pollution warning in Tivon removed: pollution caused by a fault at the refineries", H.
2003	The Minister of Infrastructure instructed the Ministry's executive director to set up an		T		16.9.2003, "The pollution caused tens of thousands to remain in their homes", H.

	investigative committee for the polluting fire in the Haifa refineries.				
2003	The Ministry of Infrastructure authorized a standard for LPG usage. LPGs are allowed on the road.			R	22.9.2003, "Israeli government, step on the gas!", H.
2003	MEP announced it will start a criminal investigation against the ECOSOL facility for treatment of toxic waste (by burning).		T		6.10.2003, "Criminal investigation against polluting plant in the south", H.
2003	Following a second fire within a week's time in the electrochemical plant near Akko, the MEP CEO set up an investigative committee.		T		3.10.2003, "Testimonies: shabby maintenance caused fire in Akko", H.
2003	The Finance Minister and the Minister of Infrastructure set the price for unleaded gasoline to be lower than gasoline with lead in order to reduce incentives for using gasoline with lead and as part of a gradual national transition to using unleaded fuel.			R	9.2.2004, "Gasoline price reduced by 1.31%; diesel price increased by 2%", H.
2004	MEP increased the number of surprise checks on air pollution emissions from factories. 156 checks were carried out (in comparison to 89 in 2001). Violations were found		T		(Ministry of Environmental Protection 2015).

	in more than 50% of the factories.				
2004	Electrochemical plant shut down due to pollution and safety transgressions after explosion in plant.		R		12.2.2007, "The concern: closing the plant will endanger the bay area", Y. 3.10.2003, "Testimonies: shabby maintenance caused fire in Akko", H. 16.10.2003, “Temporary shutdown warrant for “Electrochemical Industries” factory”, H.
2004	Euro 4 gasoline standard adopted, target date 1.10.2005			R	17.5.2005, "Trucks will continue to pollute the air", Y. 16.5.2006, "License to pollute", Y. 11.1.2006, "Environment quality report: pollution reduced in 2004 but remains at a high level", H. 9.6.2004, "Ministry of Transport fights pollution: campaign starting Sunday to examine smoke emitting vehicles", H.
2004	MOT authorized the import of hybrid vehicles.			R	9.6.2004, "Ministry of Transport fights pollution: campaign starting Sunday to examine smoke emitting vehicles", H.
2004	MEP prepared new business licenses for factories in Ramat Hovav in which they needed to take care of their own toxic wastes instead of using the problematic waste treatment plant. MEP gave a strict deadline for this change. The change concerned the planned establishment of major IDF bases in the vicinity and complaints about odors.		R		9.7.2004, "MEP: we have taken action to reduce pollution in plants till the waste treatment plant shuts down, money will be wasted in Ramat Hovav", H.
2004	The government decided to reduce the purchase tax on hybrid vehicles from 100% to 40%			R	10.2.2004, "Environment friendly car revolution reaches Israel, first seven cars sold", H.

2004	MEP started a criminal investigation against the executives of Dan Bus Company. The company was sued in 2005 and was fined 200K NS in 2006.			T	8.11.2004, "Criminal investigation launched against Dan directors due to pollution offences", H. 8.8.2007, "Pollution reduction device to be installed in 200 Tel Aviv Dan buses", H.
2005	Systems to convert vehicles to larger engines approved			R	18.1.2005, "Gas released", Y.
2005	Ministry of transport delays application of Euro 4 standard for trucks and buses till 1.10 2006			-R	17.5.2005 "Trucks will continue to pollute the air", Y.
2005	The Social-economic Cabinet approves a proposal to lay a natural gas pipe to Haifa till the end of 2007		R		28.11.2005, "The cabinet approves laying a gas pipe to Haifa to reduce pollution", H.
2005	The Haifa Bay refineries received updated emission standards. The standards were negotiated and set in 2006. These standards are still lower than European standards.		R		1.6.2006, "Haifa refineries will need to invest tens of millions of Shekels to adhere to environment quality standards", H. 15.11.2006, "Research: Haifa refinery pollution: four times more than similar European plants", H.
2006	MEP increased the number of surprise checks on air pollution emissions from factories. 334 checks were carried out (in comparison to 156 in 2005). Violations were found in about 50% of the factories.		R		(Ministry of Environmental Protection 2015). 6.11.2006, "Surprise inspections revealed excess emissions in 55% of factories", H.

2006	Haifa refinery fined 1.6 million shekel for polluting.		T		12.1.2006, "Haifa refinery fined 1.5 million shekel for polluting", Y. 19.1.2006, "Haifa refinery director summoned to hearing due to troublesome odors", H. 11.1.2006, "Haifa refinery fined 1.6 million shekel for polluting", H.
2006	Carmel chemicals fined 700K NIS.		T		
2006	Stringent polluting tests at annual vehicle license renewal.			R	3.4.2006, "Polluters will pay", Y. 26.04.2006, "Due to defective test: cars fail pollution test", Y. 26.3.2005, "As of today: stringent pollution checks in car tests", H. 5.9.2006, "How to make your car quit smoking", H.
2006	New fuel additive for trucks.			R	7.4.2006, 'The new stinking truck fuel additive", Y. 15.8.2006, "New truck fuel additive available in only 15 stations; Fuel Administration: large companies will have an independent supply", H.
2006	Implementation of Euro 4 standard for buses postponed by additional 6 months.			-R	16.5.2006, "License to pollute", Y.
2006	Car Scrappage program for old cars (1984 and pre 1984 models (not implemented).				24.8.2006, "Initiative of Ministry of Finance and Ministry of Environmental Protection: trade in your old car for 3000 shekel", H.
2007	Tax reduction on "green" cars differential taxation according to polluting level (not approved in 2007).				22.5.2007, "Car pollutes- you pay", Y. 7.11.2006, "State encourages "green" car purchase, tax increase on polluting vehicles and decrease on "clean" ones", H.
	A minister's committee approved a five-year plan for the reduction of air pollution. A second updated plan was set later on during the year.			P	10.9.2007, "Ministerial Committee on Environment Quality approves national plan for traffic air pollution reduction", H. 22.04.2007, "The government approves five year plan for traffic air pollution reduction", H.
2007	Use of 96-octane fuel terminated.			R	3.7.2007, "Soon, use of octane 96 fuel to be terminated", Y.

Appendix III: Saliency Data

Table 6. Air Pollution and Road Safety Saliency Levels

Year	Hits		Total number of articles in selected dates			Normalized hits by total number of articles		
	Air pollution	Road safety	First TUE in NOV	First WED in AUG	Average of two days	Estimated annual total	Air pollution	Road safety
1964	10	137	64	81	72.5	22620	0.000442	0.006057
1966	24	137	116	132	124	38688	0.00062	0.003541
1968	38	114	114	101	107.5	33540	0.001133	0.003399
1970	89	210	140	174	157	48984	0.001817	0.004287
1972	20	226	135	152	143.5	44772	0.000447	0.005048
1974	35	133	147	132	139.5	43524	0.000804	0.003056
1976	41	141	155	152	153.5	47892	0.000856	0.002944
1978	44	166	166	144	155	48360	0.00091	0.003433
1980	36	166	181	189	185	57720	0.000624	0.002876
1982	30	194	211	186	198.5	61932	0.000484	0.003132
1984	27	220	185	229	207	64584	0.000418	0.003406
1986	32	245	191	195	193	60216	0.000531	0.004069
1988	54	294	175	209	192	59904	0.000901	0.004908
1990	102	335	163	237	200	62400	0.001635	0.005369
1992	73	358	178	249	213.5	66612	0.001096	0.005374
1994	90	327	196	212	204	63648	0.001414	0.005138
1996	59	320	175	215	195	60840	0.00097	0.00526
1998	77	410	207	222	214.5	66924	0.001151	0.006126
2000	128	423	210	244	227	70824	0.001807	0.005973
2002	117	483	242	229	235.5	73476	0.001592	0.006574
2004	128	467	218	209	213.5	66612	0.001922	0.007011
2006	198	463	210	240	225	70200	0.002821	0.006595

Results are from Yedioth Ahronoth article database.

Search terms:

#אוויר<וגם>זיהום #

'דרכים# >וגם< (#תאונה או #תאונות)

(# allows for common Hebrew prefixes).

Conclusion

The dissertation's main subject of inquiry is the theoretical discrepancy between policy process theories that describe a punctuated equilibrium (PE) dynamic of policy change, such as multiple streams (MS) (Kingdon [1984] 1995), advocacy coalition framework ACF (Sabatier and Jenkins-Smith 1993) and punctuated equilibrium theory (PE) (Baumgartner and Jones 1993) on the one hand and case studies that describe processes of gradual policy change (Capano 2003; Cashore and Howlett 2006; 2007; Chaqués and Palau 2009; Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Kay 2011; Howlett 1994; Skogstad 1998; Weaver, 2010) on the other hand. Disproportional information processing theory (DIP) (Jones and Baumgartner 2005a, 2005b), PE's behavioral theory, is the dissertation's main theoretical framework.

More specifically, the dissertation aims to advance our understanding of gradual changes by focusing on the following questions:

A. Do gradual and accumulating policy changes occur across different levels of policymaking?
B. What are the characteristics of gradual and accumulating policy changes?
C. How do patterns of gradual and accumulating policy changes fit in the general picture of PE patterns of policy change, with regard to incidence as well as change dynamics?
D. Can DIP be refined or expanded to account for patterns of gradual and accumulating policy changes?

To address these questions the dissertation is comprised of three articles that analyze gradual policy change at three levels: a high-resolution study of air pollution policy in Israel from 2002 to 2004; a macro-level study of US federal budget changes from 1947 to 2014; and a longitudinal meso-level study of air pollution policy and road safety policy in Israel from the 1960s to 2007. Due to the inherent differences between the levels of analysis distinctive methodologies were developed for each scale.

The three articles address the four questions in several ways: With regard to question A, concerning the occurrence of policy changes across varying levels of policymaking, the articles present a unified finding that gradual changes occur at all levels of policymaking, from small accumulating changes in the regulation of air pollution to large scale budget changes. This finding, together with the case studies cited above provide a substantial basis for generalizing the

multi-level occurrence of gradual and accumulating policy change for other Western democracies and for a wide array of policy fields.

With regard to question B, concerning characteristics of policy changes, the high resolution analysis in the first article deals with two important aspects: (1) What differentiates small changes which accumulate to a major change over time from those which do not? (2) What would be a practical methodology for differentiating between the two types? With regard to the first question, the change-by-change analysis demonstrates the significance of *sequencing* for accumulation of policy changes. Sequencing occurs when policy changes are ordered, in the sense that each change continues to advance policy from where the previous change concluded. This provided the basis for defining *policy sequences*, series of non-major changes accumulating to significant change over time. With regard to the second question, the study shows that identifying policy sequences, and assessing their significance requires analysis of policy change content. For example, and as demonstrated in the article, policy changes may deal with facets of institutional friction, such as gathering information or enforcing current policy, rather than directly advancing new policy. The *friction-oriented* vs. *change-in-standards* policy content analysis, developed and applied in the first article, proved useful for differentiating between policy changes which accumulate to significant change over time and those that do not. This methodology may be useful in studies of gradual change in other policy fields, though it may require some adaptation to their specific contexts.

With regard to question C, concerning gradual and accumulating changes within the general dynamic of policy change and specifically with regard to PE patterns, the dissertation presents several notable findings. First, the second article, dealing with trends in budgeting, is the first study to present data on the overall incidence of gradual changes in policy. The article shows that in the US federal budget between 1947-2014, in 60 categories of spending consistently defined over time, more than 60% of annual changes were in trending series of four years or more. The finding attests the central role of trending series of budget changes. It is also a strong indicator of high incidence of trending changes in other types of policy changes generated by public decision makers. In addition, and most importantly, the article suggests a resolution to the theoretical discrepancy described at the opening of this chapter, between PE patterns of changes and patterns of gradual change. On the basis of an analysis of policy change at the macro level of national budgeting, we find that gradually accumulating change occurs in a

general unidirectional PE dynamic characterized by inefficient decision-making. This means that even if policy is progressing in a certain direction over an extended period of time, decision makers still find it difficult to respond in a proportional manner and continue to generate change in a disproportional pattern of policymaking. In comparison to a normal distribution of policy changes, this pattern is characterized by much more small changes than expected, less than expected medium changes and more than expected very large changes.

A complementary facet of the theoretical resolution is found at the meso and high resolution studies, the third and first articles respectively. These show that although PE patterns are the general rule there still may be periods of more gradual and proportional change. Hence, policy sequences can be considered as a third policymaking mode. As discussed in the introduction, Lindblom (1979) explicitly envisioned this mode of policy-making. However, this possibility was not accounted for in policy process theories such as MS, ACF and PE, which focus on the factors and conditions enabling major changes (Schlager 2007). A policy sequence is best demonstrated in the third article in the case of vehicle air pollution in Israel from the late 1990s to the mid first decade of the new millennium. During this period policy substantially advanced without any major changes taking place.

With regard to question D, the first and third articles suggest refining DIP to accept that gradual and accumulating change may emerge when signals point in a certain direction of policy over an extended period of time. In addition, findings in the third article suggest refining DIP to accept that gradual and more proportional change may occur when there is a gap between the level of signal strength and institutional friction, with the former strong enough to drive non-major changes and the latter weak enough to allow for accumulation over time. Finally, within policy areas in which change generally progresses in a certain policy direction over time, findings from the third article suggest that the interplay of signal strength and institutional friction generates four archetypal patterns: slow incremental, gridlock, frequent punctuations and infrequent punctuations with specific findings validating the first three pattern types. These suggested expansions relate to DIP's theoretical core as they concern two main factors in DIP that account for PE patterns of change – signal strength and institutional friction. The general impact of both these factors on policy change patterns has been theorized by other scholars (Jones and Baumgartner 2005). However, a comprehensive examination of the impact of

different intensities of these two factors on policy change patterns has not been previously attempted.

The possibility of trending series of change and policy sequences has implications for other theories of the policy process such as MS and ACF. Similarly to PE, these theories focus on factors and conditions enabling major changes and they should be challenged to also specify factors and conditions that may lead to patterns of accumulating policy change. In the case of MS this may be a certain configuration of the streams and in the case of ACF this may be a gradual change in public opinion which in turn gradually affects both coalitions' policy beliefs.

There are several limitations concerning the findings that should be noted. First, the methodology used in the first article, for differentiating between policy changes which are part of accumulating sequences and those which are not, needs to be further tested in other policy fields and may require adaptation for specific policy contexts. Secondly, findings concerning the incidence of trending series of budget changes suggest PE patterns for other types of policy changes. Indeed findings from the longitudinal cases in the third article verify this pattern for the cases of road safety and air pollution policy in Israel. A more conclusive generalization requires further testing in other policy fields and political systems. Thirdly, asserting the suggested expansions of DIP theory also requires further testing across a broader range of countries and policy areas, as well as further investigation of the mechanisms by which different intensities of each factor, i.e. signal and institutional friction, impact policy change patterns. In addition, the consequences of the suggested interplay between the two factors, only account for cases of trending policies. In general it should be taken into account that findings from the first and third article were reached within the political institutional context of a coalition parliamentary government system and findings from the second article were reached within the political institutional context of a presidential government system. The former is generally considered to be more responsive to public opinion than the latter (Lijphart 2012). Hence the need for further testing as described above.

Several directions for future research stem from the dissertation. One, is dealing with the limitations of the findings as described above. Two, further refinement or expansion of DIP theory, focused on the consequences of the interplay between signal levels and institutional friction intensity, should be undertaken to account for cases where policy does not trend in a certain direction. Three, the suggested refinements to DIP should be further explored by taking

into account varying levels of information processing capacities in government units. Limited information processing capacities is another central factor in DIP theory explaining disproportional policy outputs. Hence, the extent of these capacities may be of consequence for patterns of policy change (see Epp and Baumgartner 2016). Differing between signal types may also be of interest as is further conceptualization of institutional friction and the development of more methods for its measurement. Four, as explained above, efforts for refining or expanding other theories of the policy process to account for trending changes and periods of more proportional, gradual and accumulating change would be of interest and may enhance their explanatory power. Lastly, further development of methodologies for differentiating between changes which are part of policy sequences and those which are not is also of interest as most policy changes are small.

Summing up the conclusions, the dissertation resolves a gap between central theories of the policy process, specifically PE and DIP, and cases of gradual change which were not specifically accounted for by these theories. The dissertation shows that gradual changes are common and central to policymaking though in the long-term they occur in a unidirectional PE pattern. Within an elaborate version of DIP, the dissertation suggests, that various configurations of intensity of signals and institutional friction, generate four differing policy patterns. These patterns add up to a general PE pattern of change. Nevertheless, periods of more proportional, gradual and accumulating change may emerge under specific conditions detailed in the study. In addition, the study has significant implications for how we understand small changes, or specifically, non-major changes. Small changes are by far the more common as seen in the high density of small changes in annual national budget change distributions of many Western democracies (Jones et al 2009). The dissertation shows that these cannot be treated as simply insignificant changes as a significant amount of small changes may very well be part of trending series of changes, which may include periods of more proportional though significant policy sequences.

The dissertation began with a conundrum involving two often heard and contradicting complaints, ‘nothing has really changed’ and ‘things are not as they used to be’. The dissertation’s findings respond by explaining that the political landscape can appear both stagnant and volatile at the same time, while subtle changes are also taking place. During any given period, some issues evolve in trending PE patterns or in more proportional policy

sequences, while others are static and a few go through abrupt drastic changes. Hence, when analyzing the government's seemingly routine outputs, we should be sensitive to patterns of gradual change.

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Acknowledgments

Financial support was provided from the following institutions:

- A doctoral fellowship from the Environment and Health Fund, Jerusalem, Israel
- A doctoral scholarship from the Ran Naor Institute for the promotion of research in road safety, Hod Hasharon, Israel.
- A doctoral scholarship from Federmann School for Public Policy and Government, Hebrew University, Jerusalem Israel.
- A doctoral scholarship from the Advanced School for Environmental Studies, Hebrew University, Jerusalem, Israel.
- A doctoral scholarship from the Levi Eshkol Institute and Shaine Center, Hebrew University, Jerusalem, Israel.

I would like to express my deepest thanks and appreciation to the following:

Professor Eran Feitelson, my advisor, without his wise guidance and feedback and persistent support this dissertation would not have been possible.

Professor Frank Baumgartner, a committee member, for providing me with invaluable feedback and encouragement and for his generous hospitality at the University of North Carolina.

Professor Chinitz and Professor Sulzeano-Keninan, committee members, for their support and guidance.

Professor Bryan Jones for providing me with invaluable feedback and encouragement and for his generous hospitality at the University of Texas.

Professor Christian Breunig, Professor Sharon Gilad, Professor Grace Skogstad, Professor Martin Lodge, Professor Shlomo Mizrahi, Professor Moshe Maor for very helpful feedback and support.

Jessica Genauer from the Australian National University for her perceptiveness and generosity.

Professor Deborah Shmueli, Professor Amnon Reichman and Dr. Michal Ben Gal from the Minerva Center for the Rule of Law under Extreme Conditions at the University of Haifa for their invaluable support.

Dr. David Segal, my father, for assistance with editing the dissertation.

Dr. Ruth Ostrin and Dr. Sari Rosen from the Environment and Health Fund, Dr. Tsippy Lotan and Ofra Bigger from the Ran Naor Institute, Professor Levi-Faur, Meital Shtain and Ofra Toren-Commere from the Federmann School for Public Policy and Government, Liora Haver from the Advanced School for Environmental Studies and Institute for their generous and pleasant support.

Uri Isserles and Danielle Zaychik for their vital assistance in the research.

Finally, I would like to thank my family for supporting me in this project, dear Bonnie and Maurice, dear Batya, my dear parents David and Aline, my lovely Ruthi, and my children Aner, Oriya and Amir.

דפוסי שינוי הדרגתי במדיניות ציבורית

חיבור לשם קבלת תואר דוקטור לפילוסופיה

מאת אהוד סגל

הוגש לסנט האוניברסיטה העברית בירושלים
דצמבר 2016

עבודה זו נעשתה בהדרכתו של:

פרופסור ערן פייטלסון
האוניברסיטה העברית בירושלים

תקציר

עבודת המחקר עוסקת בפער התיאורטי בין תיאוריות שינוי מדיניות המחזיקות בכך ששינויים גדולים וחדים הם שמאפיינים שינוי מדיניות משמעותי, כגון תיאוריות הזרמים (multiple streams) (Kingdon [1984] 1995) מסגרת קואליציות סנגור (advocacy coalition framework) (Sabatier and Jenkins-Smith 1993) ותיאוריית שיווי משקל מקוטע (punctuated equilibrium theory) (Baumgartner and Jones [1993] 2009), למקרי חקר המתארים תהליכים של שינוי מדיניות הדרגתי ומשמעותי (Capano 2003; Cashore and Howlett 2006; 2007; Chaqués and Palau 2009; Coleman, Skogstad, and Atkinson 1996; Daugbjerg 1997; 2003; Kay 2011; Howlett 1994; Skogstad 1998; Weaver, 2010). תיאוריית עיבוד מידע א-פרופורציונאלי (disproportional information processing theory) (Jones and Baumgartner 2005), התיאוריה ההתנהגותית של תיאוריית שיווי משקל מקוטע, היא המסגרת התיאורטית המרכזית של עבודת המחקר.

באופן יותר פרטני עבודת המחקר מבקשת לקדם את הבנתנו אודות שינויי מדיניות הדרגתיים על ידי התמקדות בשאלות הבאות:

א. האם שינויי מדיניות הדרגתיים מתרחשים ברמות שונות של קביעת מדיניות?

ב. מהם המאפיינים של שינויי מדיניות הדרגתיים ומצטברים?

ג. כיצד שינויי מדיניות הדרגתיים ומצטברים משתלבים בתמונה הכללית של שיווי משקל מקוטע מבחינת שכיחותם ומבחינת דינמיקת השינוי?

ד. כיצד ניתן להרחיב את תיאוריית עיבוד מידע א-פרופורציונאלי כך שתסביר שינויי מדיניות הדרגתיים ומצטברים?

כדי לתת מענה לשאלות אלו עבודת המחקר כוללת שלושה מאמרים שבוחנים שינויי מדיניות הדרגתיים בשלוש רמות: מחקר ברזולוציה גבוהה של מדיניות זיהום אוויר בישראל בין השנים 2002-2004; מחקר בקנה מידה מקרו של שינויים בתקציב הפדראלי בארה"ב בין השנים 1947-2014; ומחקר אורך בקנה מידה בינוני (meso) של מדיניות זיהום אוויר ומדיניות בטיחות בדרכים בישראל בין השנים 1960 ל-2007. עקב הבדלים מובנים בין רמות הניתוח, שיטות מחקר ייעודיות פותחו עבור כל אחת מרמות הניתוח.

שלושת המאמרים מספקים מענה לארבעת השאלות במספר אופנים: ביחס לשאלה א', המאמרים מציגים ממצא אחיד ששינויים הדרגתיים מתקיימים בכל הרמות של עשיית מדיניות, משינויים קטנים ומצטברים בהסדרה של זיהום אוויר ועד לשינויי תקציב בקנה מידה לאומי. ממצא זה, יחד עם מקרי החקר שהוזכרו לעיל, מעניק בסיס משמעותי לקביעה ששינויי מדיניות הדרגתיים הם דפוס נפוץ של עשיית מדיניות בדמוקרטיות מערביות ובתחומי מדיניות רבים.

ביחס לשאלה ב', המאמר הראשון מדגים את המשמעות של *שרשור* כדי ששינויי מדיניות יצטברו לשינוי יותר משמעותי. הדבר עומד בבסיס המושג המוצע *שרשראות מדיניות*, המוגדרות במחקר כסדרות של שינויים לא גדולים אשר מצטברים לשינוי משמעותי לאורך זמן. המאמר גם מראה שזיהוי שרשראות מדיניות והערכת משמעותם דורשים

ניתוח תוכן של שינויי המדיניות. לשם כך, פותחה מתודולוגיה ייעודית אשר יושמה על מקרי החקר של מדיניות זיהום אוויר בישראל במאמר הראשון ובמאמר השלישי, ואשר הוכיחה את יעילותה באבחנה בין שינוי מדיניות שמצטברים לשינוי משמעותי לאורך זמן לאלו שאינם.

ביחס לשאלה ג', המאמר השני מראה שבתקציב הפדראלי האמריקאי, בשנים 1947-2014, בשישים תחומי מדיניות שהוגדרו באופן עקבי לאורך השנים, יותר מ-60% מהשינויים השנתיים היו בסדרות כיווניות של שינוי, בין אם גידול או קטון, של ארבע שנים או יותר. הממצא מאשרר את התפקיד המרכזי של סדרות כיווניות של שינוי תקציבי בלוגיקה של תקצוב ציבורי. כמו כן, הוא ראיה משמעותית להיקפים נרחבים של סדרות כיווניות בשינויי מדיניות מסוגים אחרים. בנוסף ובחשיבות יתרה, המאמר מציע פתרון לפער התיאורטי בין דפוסי שינוי של שיווי משקל מקוטע לבין שינויים הדרגתיים של מדיניות: שינוים הדרגתיים הנם שכיחים, יחד עם זאת הם מתקדמים בדינמיקה כללית של שיווי משקל מקוטע. משמעות הדבר היא שאפילו אם מדיניות מתקדמת בכיוון מסיום לאורך תקופה ממושכת, מקבלי החלטות עדיין יתקשו להגיב באופן פרופורציונאלי.

פן המשלים לפתרון התיאורטי הנ"ל מוצג במחקרים של הרזולוציה הגבוהה ושל קנה המידה הבינוני. אף על פי שדפוס שיווי משקל מקוטע, בין אם כיווני או לאו, הנו דפוס השינוי האופייני באופן כללי, עדיין עשויים להיות פרקי זמן של שינוי יותר הדרגתי ופרופורציונאלי. רצף מדיניות שכזה מודגם בצורה מיטבית במאמר השלישי במקרה של מדיניות זיהום אוויר מכלי רכב בישראל החל מסוף שנות ה-90 ואמצעי העשור הראשון של האלף החדש. בתקופה זו המדיניות התקדמה באופן משמעותי וללא שינויי מדיניות גדולים. לסיכומו של עניין, שני הפנים של הפתרון התיאורטי מסבירים כיצד הנוף הפוליטי יכול להיראות הן בקיפאון והן בלתי יציב בעת ובעונה אחת, בזמן ששינויים קטנים מתרחשים.

ביחס לשאלה ד', המאמר הראשון והשלישי מציעים להוסיף לתיאוריית עיבוד המידע הא-פרופורציונאלי את האפשרות ששינויי מדיניות הדרגתיים יכולים להופיע כאשר יש פער בין עוצמת האותות ביחס לסוגיה שעל הפרק ובין ההתנגדות המוסדית לשינויי ביחס אליה. הדפוס מתאפשר כאשר עוצמת האותות חזקה מספיק כדי להניע שינויי מדיניות לא גדולים וההתנגדות המוסדית חלשה מספיק כדי לאפשר הצטברות הדרגתית של שינויים לאורך זמן. לבסוף, לגבי תחומי מדיניות בהם שינויי המדיניות הנם בכיוון מדיניות מסוים לאורך זמן, ממצאים מהמאמר השלישי מציעים שיחסי הגומלין בין עוצמת האותות והחיכוך המוסדי מייצרים ארבעה דפוסים ארכיטיפים של שינוי מדיניות: קיבעון, הדרגתי-איטי, קיטועי מדיניות תדירים וקיטועי מדיניות שאינם תדירים, כאשר ממצאים פרטניים מאשררים את שלושת הדפוסים הראשונים. הרחבה תיאורטית זו מתייחסת לגלעין התיאורטי של תיאוריות עיבוד מידע א-פרופורציונאלי, מכיוון שהיא מתמקדת בשני גורמים מסבירים עיקריים בתיאוריה – עוצמת האותות וחיכוך מוסדי.

לסיכום, עבודת המחקר מציעה פתרון לפער בין תיאוריות מרכזיות של שינוי מדיניות, ובפרט שיווי משקל מקוטע ועיבוד מידע א-פרופורציונאלי, ומקרים של שינוי הדרגתי, שאינם מוסברים באופן ישיר בתיאוריות הללו. עבודת המחקר מראה ששינויי מדיניות הדרגתיים הם שכיחים ומרכזיים בעשיית מדיניות ציבורית, אולם בטווח הארוך הם מתרחשים בדפוס חד-כיווני של שיווי משקל מקוטע. במסגרת גרסה מפורטת של תיאוריית עיבוד מידע א-

פרופורציונאלי, עבודת המחקר מציעה שתצורות שונות של עוצמת אותות וחיכוך מוסדי, מייצרות ארבע דפוסי מדיניות שונים. דפוסים אלו מצטרפים יחדיו לדפוס שיווי משקל מקוטע. יחד עם זאת, הדפוס עשוי לכלול תקופות של שינוי הדרגתי ויותר פרופורציונאלי תחת תנאים מסוימים המפורטים בעבודת המחקר. בנוסף, למחקר השלכות משמעותיות לאופן בו אנו מבינים שינויים קטנים. הללו הם השכיחים ביותר מבין שינויי המדיניות ואין להתייחס אליהם כשינויים לא משמעותיים, מכיוון ששינויים קטנים רבים עשויים להיות חלקים מסדרות כיווניות של שינויי מדיניות אשר מצטברים לשינוי משמעותי. לכן, בעת ניתוח של תפוקות מדיניות שגרתיות לכאורה, עלינו לשים לב לדפוסים של שינוי הדרגתי.