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Keywords: bureaucracy; Congress; public policy; problem definition Corresponding Author Samuel Workman

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Abstract

Federal bureaucrats are important sources of information about policy problems. However, federal officials compete for this influence with organized interests plying their own problems and solutions. We attribute the differential agenda influence of the federal bureaucracy to efforts in Congress to construct workable problem definitions in a context of uncertainty about issues. From both behavioral and rational models of congressional decision making, we develop a theory of congressional search for information during problem definition under conditions of uncertainty. The theory presages the prominence of federal bureaucrats in this search, and especially under uncertainty. Using new data sets capturing the appearance of federal bureaucrats at congressional hearings, we find that the mobilization, prominence, and types of federal bureaucrats providing information is explainable in terms of congressional uncertainty about problem definitions.

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1. Introduction

Federal bureaucrats are important sources of information in the policy process (Workman, Jones, and Jochim, 2009; May, Koski, and Stramp, 2014). Scholars often depict bureaucrats' informational advantage as so powerful that incentive and personnel systems are necessary to thwart bureaucratic drift (Epstein and O'Halloran, 1999; Huber and Shipan, 2002; Lewis, 2008; Gailmard and Patty, 2013). In theories of public policy, bureaucracies occupy a central position in policy subsystems (May et al., 2006) and make up part of the web of actors, including organized interests, generating information about public policy (Miller, 2004; May, Sapotichne, and Workman, 2006, 2009b). More recently, scholars have emphasized that the information generated by federal bureaucracies is shaped by, and influences, agenda setting

13 and problem definitions at higher levels of government (Baumgartner and
14 Jones, 2014; Workman, 2015). Federal bureaucracies provide information
15 about policy problems in a pluralistic political context where they not only
16 compete with organized interests, but also with other federal bureaucracies
17 (Workman and Shafran, 2015).

18 The crafting of a working definition of a problem allows the construc-
19 tion of policies, or solution sets, for those problems (Simon, 1996; Jones,
20 2001). Problem definitions are important because they offer opportunities
21 for bureaucracies and other actors to expand influence, but also offer fissures
22 that allow actors to exploit deficiencies in the current definition, or under-
23 standing, of a problem and induce policy change (Dery, 1984). Given this,
24 the ability to influence problem definitions implies the ability to steer policy
25 change. Political scientists have not paid a great deal of attention to prob-
26 lem definitions in recent decades, despite their importance for policy change.
27 Moreover, bureaucracies represent the institutionalization of particular defi-
28 nitions of policy problems (Workman, 2015, pp. 138-146), and considerable
29 politics surround efforts to alter how bureaucracies define the problems they
30 confront (May, Workman, and Jones, 2008). As such, the crafting of prob-
31 lem definitions, or working understandings, is a prime target of information
32 generation and politicking of all types in the policy process, and especially
33 in legislative policy making.

34 What drives attention to federal bureaucrats in the congressional search
35 for information about policy problems? What types of bureaucrats are privi-
36 leged in the construction of problem definitions? Theories about how federal
37 bureaucracies operate in the policy process offer leverage in understanding
38 how members of Congress might use bureaucrats in reaching an understand-
39 ing of various policy problems. We argue that uncertainty guides decision
40 making and choices about how to define a problems and search for informa-
41 tion. We combine older insights from the fields of psychology and commu-
42 nication with those from public policy to derive some hypotheses about how
43 best to understand the provision of information by bureaucrats and their
44 prominence in policy debates. We assert that the central tenets of these
45 theories have implications for the dynamics of mobilization in the hearing
46 process and extend to how Congress searches for external information con-
47 cerning policy problems.

48 We view bureaucratic participation as partly a consequence of the efforts
49 of Congress to reduce uncertainty in decision making—especially concerning
50 problem definition. These arguments are quite distinct from those charac-

51 terizing standard theories of group mobilization and influence in the policy
52 process. We test our basic assertions by examining the participation of federal
53 bureaucrats in hearings on business and financial regulation over a significant
54 period of time. While highlighting the importance of bureaucrats to congressional
55 information gathering, our findings also hold more general implications
56 for how we view the way in which Congress searches for information.

57 **2. Issue Dynamism and Boundary-Spanning Problems**

58 The sources of congressional uncertainty about problem definitions are
59 twofold. The ability to prioritize policy issues and generate solutions pre-
60 supposes that specific actors have jurisdiction over the problem and that
61 the problem is defined in such a way as to allow solution generation. Congressional
62 committees quite often engage in fierce competition in what King
63 (1997) calls “turf wars” for jurisdictional supremacy and to control the contours
64 of policy debate (Baumgartner, Jones, and MacLeod, 2000). That
65 policy issues can be categorized easily is a more tenuous notion given the evolution
66 and redefinition of policy issues (Jones and Baumgartner, 2005) and
67 the interdependence of issues wrought by boundary-spanning policy problems
68 (May, Sapotichne, and Workman, 2009a; May, Jochim, and Sapotichne, 2011;
69 May and Koski, 2013).

70 Issues like climate change, homeland security, food security, and energy
71 are examples of issues that span the boundary of existing issues, policies, and
72 governing arrangements. These issues become ill-fit to existing structures
73 for allocating attention (Sheingate, 2006). That is, they reside between or
74 among substantive issues and functionally distinct governing arrangements.
75 Their location in the agenda space sets in motion the struggle to define these
76 problems. For instance, climate change defined in terms of environmental
77 protection implies very different policies and considerations than does climate
78 change understood in terms of its energy related dimensions. Such issues
79 strain the existing set of governing arrangements and generate uncertainty
80 about how to understand the policy problem. How might we expect the
81 dynamics of issues to influence information search in legislatures?

82 Homeland security policy in the United States is an instructive case for
83 beginning to understand how uncertainty about problem definitions might
84 influence congressional information search. Standard distributional explanations
85 of interest mobilization in this policy area would have predicted massive
86 subsystem upheaval in the wake of the terrorist attacks of September 11,

87 2001. All the elements for such a disruption were there. Massive resources,
88 financial and otherwise, were available for analyzing, preventing, and miti-
89 gating future attacks. The federal bureaucracy was the target of great scorn,
90 suggesting its value to Congress in information provision would have been
91 down-graded. The creation of a “new” issue area and bureaucratic organi-
92 zational upheaval might have suggested an opportunity for a restructuring
93 of policy and flood of new participants into the policy process as Congress
94 struggled to come to grips with the issue. This view of the potential of this
95 disruption is heightened by the tremendous amount of money available for
96 various programs protecting the homeland.

97 Yet, there was no “gold rush.” Research documents, in the case of fed-
98 eral policy on the risk associated with homeland security, that Congress
99 faced mounting uncertainty in this issue area as the new millennium began
100 and that the stability of the issue areas that might have been affected was
101 astounding—to the point of inertial. And further, this stability was marked
102 not only in the case of organized interests, but most especially in terms of
103 the set of federal bureaucracies tasked with policymaking on the issue areas
104 affected (May, Sapotichne, and Workman, 2009a,b). Bureaucrats were cen-
105 tral in defining the general directions of policy under extreme conditions of
106 uncertainty. Further, the ultimate policy solution was an internal bureau-
107 cratic solution (May, Workman, and Jones, 2008; May and Workman, 2009).
108 This discussion focuses on the importance of bureaucrats in policy making
109 generally and processes of congressional search in particular. This instructive
110 case sets the stage for a general logic of congressional search for information
111 grounded in uncertainty about how to understand policy problems and craft
112 definitions that would allow the generation of solutions.

113 3. Problem Definition and the Bureaucracy

114 Why are federal bureaucrats central to establishing working problem def-
115 initions, especially under conditions of uncertainty? From the vantage point
116 of Congress, their competitors in the system of organized interests populating
117 any given policy area faces market-like pressures on their survival as some
118 groups fade away and others rise to prominence in the competition to repre-
119 sent latent interests. While the groups populating the interest system face
120 competitive pressures for survival, they must also confront the ever-present
121 internal tensions deriving from the politics of collective action that threaten
122 to destroy or dissolve given organizations (Olson, 1965). These constitute

123 market-like forces for interest representation and influence mobilization and
124 information from the “supply” side.

125 Three characteristics of information are key for reduction of uncertainty
126 in the political and policy calculus of legislators: accuracy, reliability, and
127 consistency in supply. First, information must be factual or truthful in some
128 sense, or at least close enough to allow the accurate weighting of the infor-
129 mation. Second, information must be reliable. Legislators would like infor-
130 mation that is not only “right” on average, but must also have low variance.
131 Third, policymakers require a consistent supply of information to inform
132 both policy and political calculations. Volatility in the supply of informa-
133 tion destabilizes congressional policy making. These central characteristics
134 of information supply highly recommended federal bureaucracies as primary
135 suppliers of information in American politics generally, and especially under
136 the uncertainty wrought by issue redefinition and boundary-spanning prob-
137 lems.

138 Bureaucracies generally have longer shelf-lives than the vast majority of
139 groups populating the interest system. This is due to the nature of competi-
140 tion these groups face in the “interest marketplace”, and is true not only in
141 terms of the overall supply of groups, but also in the makeup of the popula-
142 tion. Even as organized interests proliferate, the life-span of any given group
143 is necessarily short in comparison to federal agencies. The nature of compe-
144 tition in the interest system compromises the consistency and reliability of
145 information from these groups within any given issue area. Federal agencies
146 on the other hand do not face similar competition in the public sector.¹

147 Federal agencies are also imbued with missions by federal statute and
148 populated by professionals beholden to the norms of both their profession and
149 to the organization. This promotes the type of stability, for better or worse,
150 that increases the consistency and reliability of information from the federal
151 bureaucracy. This is not to say that bureaucrats are less self-interested than
152 organized interests, but simply that they do not face the same economic
153 pressures (both external and internal) that private sector groups face.

154 What of the accuracy of information? The tendency for biased informa-
155 tion is in part mitigated by two factors. Bureaucrats, by virtue of longevity,
156 are engaged a repeated interaction, or game, with Congress in an effort to

¹Little scholarship exists on the effect on information of government contracting, which may introduce a degree of market-like pressures to the public sector.

157 define policy problems (Aberbach, 1990; Workman, 2015). In the long run
 158 interaction, preferences are revealed. This means is that while bureaucrats
 159 may very well bias their provision of information to policymakers, policymak-
 160 ers are likely aware of the biases (detected over decades of interaction) and
 161 are able to weight these biases more accurately (compared to groups) in their
 162 decision calculus. The result is that, even if the provision of information is
 163 biased, repeated relationships allow for the systematic adjustment of stance
 164 based on even biased information. Note that this is true *if* bureaucrats are
 165 consistent in supplying information. In short, smaller variance sometimes
 166 trumps pin-point accuracy.

167 Given the competitive institutional dynamics of policy issues and boundary-
 168 spanning problems, information not provided by one entity, will assuredly be
 169 supplied by another in an effort to steer policy debate and influence problem
 170 definitions (Workman and Shafran, 2015). Private information is revealed
 171 in the competition for ideas. The ideas and argument presented above lead
 172 to the general expectation that bureaucrats will be influential in processes
 173 of congressional search and problem definition. Research on communication
 174 in social psychology offers a convenient way to gauge the prominence of bu-
 175 reaucrats in policy debates.

176 4. General Implications

177 Congressional hearings serve multiple purposes including *information gath-*
 178 *ering*. Bureaucrats are important sources of policy- and politically-relevant
 179 information. Where policy is concerned, bureaucrats have expertise on par-
 180 ticular issues, having worked on problems for long periods of time. Bureau-
 181 crats are also important sources of information during partisan transitions in
 182 two ways. First, they offer insights into policy making not available elsewhere
 183 for new legislators. Second, political appointees in particular are indicators
 184 of executive branch stances on issues. We argue that the main driver of bu-
 185 reaucratic prominence in the hearing process is the degree of uncertainty in
 186 developing a working problem definition. Where uncertainty concerning the
 187 nature of the problem is high, we expect the participation and prominence
 188 of federal bureaucrats to increase for reasons that follow from the discussion
 189 in Section 3. This leads to our first hypothesis.

190 **Hypothesis 1 (Bureaucratic Participation)** *Increases in congressional*
 191 *uncertainty about problem definitions will lead to increases in the frequency*
 192 *of bureaucrats testifying at congressional hearings.*

193 In particular, bureaucrats are likely to be most prominent in the defin-
194 ing of policy problems, as opposed to choice of solutions. This is in part
195 because preferences attached to policy problems are likely less “sticky” than
196 those attached to solutions. This also suggests that bureaucrats are less
197 prominent where solutions are “locked in” or the solution itself defines the
198 problem. While it is true that both politicians and bureaucrats have well-
199 defined preferences over different policy solutions (e.g., market mechanisms
200 versus regulation), it is less clear that they hold different preferences regard-
201 ing particular policy problems (e.g., investor protection versus accounting
202 rules in the case of securities regulation). Participation in the hearing pro-
203 cess provides bureaucrats an important opportunity to aid in defining the
204 parameters of policy debate, even if there is less influence over the solution
205 set.

206 Where the defining of policy problems is concerned, bureaucratic promi-
207 nence, and not just participation, is also an important consequence of un-
208 certainty. In the study of communications in social psychology, research has
209 long identified the importance of primacy in persuasion (Hovland, 1966; Tet-
210 lock, 1983). That is, the most influential arguments are those made first,
211 in part because these are remembered and frame the debate both during
212 and following consideration of the problem, respectively. Consistent with
213 this general reasoning, we expect that as congressional uncertainty increases,
214 not only will bureaucratic participation increase, but their prominence, or
215 primacy in the policy debate, will also increase. Bureaucrats will occupy
216 primary positions in the hearing process affording them an opportunity to
217 define the issues and frame the debate. This leads to our second hypothesis.

218 **Hypothesis 2 (Bureaucratic Primacy)** *Increases in congressional uncer-*
219 *tainty about problem definitions will lead to increases in bureaucratic primacy—*
220 *bureaucrats will more frequently appear first in the hearing testimony.*

221 The same general arguments that allow us to distinguish between the
222 participation of federal bureaucrats and organized interests also imply a dis-
223 tinction between the different types of federal bureaucrats that are likely
224 to be prominent under conditions of uncertainty. For reasons of reliabil-
225 ity, and stability of the information provided, conditions of uncertainty are
226 likely to foster the participation and prominence of *career* federal bureau-
227 crats. Careerists are likely to be a much more reliable and consistent supply
228 of information generally. This is because they are not subject presidential

229 personnel systems aimed at ideological congruence, and are not subject to
230 the strong shifts in political climate faced by political appointees. In the re-
231 peated game discussed in Section 4, they hold stronger bonds with members
232 of Congress and committee staff. Therefore, we expect that under conditions
233 of uncertainty surrounding problem definitions, not only will federal bureau-
234 crats be more prominent players in policy making, but the participation of
235 career bureaucrats will also increase.

236 **Hypothesis 3 (Careerists Participation)** *Increases in congressional un-*
237 *certainty about problem definitions will lead to increases in the frequency of*
238 *career bureaucrats testifying at congressional hearings.*

239 5. Problem Definition in Business and Financial Regulation

240 In examining our assertions about bureaucratic participation and promi-
241 nence in policy making, the focus of our study is congressional attention to
242 business and financial regulation from January 1983 through September 2005
243 in the United States. Business and financial regulation is not only a perenni-
244 ally prominent issue on the governmental agenda, but it also activates strong
245 systemic impulses for the mobilization of organized interests. In this way,
246 business and financial regulation is unlike macroeconomic policy, where it
247 might be expected that bureaucrats are much more central regardless of the
248 uncertainty characterizing policy making. In order to examine the partici-
249 pation of federal bureaucrats in congressional policy making, we use a data
250 set that allows us to trace policy making on business and financial regulation
251 over long periods of time. In particular, we have characterized congressional
252 uncertainty primarily in terms of the definition of policy problems. This
253 places weighty importance on our ability to gauge the different substantive
254 dimensions of business and financial regulation that are the subject of gov-
255 ernmental attention at any one point in time.

256 The indicator used to operationalize the content of congressional atten-
257 tion to (and uncertainty in) business and financial regulation is the archive of
258 congressional hearings housed at the Comparative Agendas Project (CAP).²

²The data used here were originally collected by Frank R. Baumgartner and Bryan D. Jones, with the support of National Science Foundation grant numbers SBR 9320922 and 0111611, and are distributed through the Department of Government at the University of Texas at Austin. Neither NSF nor the original collectors of the data bear any responsibility for the analysis reported here.

259 Using the Comparative Agendas Project's archive of congressional hearings
260 and topic coding scheme, we identified congressional hearings each month
261 from January 1983 through September 2005 dealing with business and fi-
262 nancial regulation.³ Because coding at the hearing level can mask the im-
263 portance, or unimportance, of some issues, we use a count of the number of
264 hearing days for the various topics in business and financial regulation for
265 each month of the time period under study.⁴ In all, there were 4,019 con-
266 gressional hearing days devoted to business and financial regulation over the
267 period under study (see Figure 1).

268 Each hearing provided by the CAP included the identifying Congressional
269 Information Service (CIS) number and using these we recorded each witness
270 (both federal bureaucrats and organized interests) present at each hearing on
271 business and financial regulation over the time period under study via Lexis-
272 Nexis Congressional. We recorded the witness' names, along with their title
273 and affiliation as well as their order of testimony and date of appearance
274 before Congress. This yielded a total of 25,681 witnesses over the period un-
275 der study. Using these indicators, we constructed measures of congressional
276 uncertainty in business and financial regulation and the participation and
277 prominence of federal bureaucrats over time.

278 Figure 1 displays the count of congressional hearing days devoted to the
279 various topics making up business and financial regulation in the CAP topic
280 coding scheme. Figure 1 shows that while congressional attention is dis-
281 persed across quite a few topics, four major sub-issues dominant congres-
282 sional attention to business and financial regulation. Corporate management
283 (10.6%), which includes mergers and acquisitions, financial institutions reg-
284 ulation (17.2%), securities and exchange regulation (11.5%), and small busi-
285 ness programs (21.3%) garner the lion's share of congressional attention in
286 this major policy issue. Note that business and financial regulation contains
287 sub-issues or elements which span both governmental regulation of business
288 as well as governmental promotion of business (as is largely the case in small

³The Policy Agendas Project codes each hearing into a set of 19 major topic categories dealing with the substance or content of each hearing, and nested within these, they are coded into one of 226 subtopic codes. For a full explication of the topic coding scheme see www.comparativeagendas.net.

⁴For instance, a hearing lasting one day on the regulation of white-water rafting in West Virginia is likely not as important as a hearing lasting ten days on the regulation of large financial institutions.

Figure 1: Congressional Hearing Days on Business and Financial Regulation by Topic.

The figure displays the total frequency of congressional hearing days on business and financial regulation by topic from January 1983 through September 2005.

business, disaster management, and patent and copyright regulation). A cursory glance at Figure 1 also helps to put the 2008 financial crisis and proposed solutions to this crisis in perspective. While attention and solutions centered on regulation, and the propping up, of financial institutions and securities markets, the “other” side of the problem, bankruptcy and consumer finance, received very little attention over the time period under study leading up to the crisis.

In any event, Figure 1 shows that while some components of business and financial regulation receive low quantities of attention in Congress, the spread of attention across topics, or elements of the “problem” of business and financial regulation can be quite broad. In terms of gauging uncertainty in this issue area where policy substance is concerned, this fact calls for a measure that is able to not only tap into the levels of attention, but also capture the spread of this attention across topics.

303 5.1. *Measuring Congressional Uncertainty and Bureaucratic Participation*

304 In order to measure the uncertainty contained in congressional efforts
 305 to understand the evolving problem of business and financial regulation, we
 306 use our hearings data to construct a measure of hearing entropy over the
 307 time period under study. Entropy, or Shannon’s H (Shannon and Weaver,
 308 1949), is used to characterize the uncertainty associated with incoming in-
 309 formation. While it was originally developed in the mathematical theory of
 310 communication (Pierce, 1980), it has also been used in the study of public
 311 policy more recently (Sheingate, 2006; Boydston, Bevan, and Thomas, 2014).
 312 The chief idea behind entropy is that incoming information should allow the
 313 receiver to learn something new about the environment from which the in-
 314 formation emanated. If the receiver can “categorize” new information quite
 315 easily, then the receiver has learned nothing new. However, if the informa-
 316 tion is difficult to categorize then the receiver is able to learn more about
 317 the environment from which the information is coming. Formally, entropy is
 318 defined⁵: $\sum_{i=k}^k p * \log_k (1/p)$.

319 In this case there are k topics in which to categorize information and the
 320 proportion (p) of cases falling in any one topic multiplied by the log (base =
 321 k) of the inverse of the proportion of that topic. For our purposes, we want a
 322 measure of the uncertainty contained in the agenda for business and financial
 323 regulation over the time period under study. The CAP contains 12 sub-topics
 324 or issues falling under the broad area of business and financial regulation (see
 325 Figure 1). Thus, for our purposes, $k = 12$. Summing across all k yields a
 326 measure of the uncertainty contained in the entire system for categorization
 327 of business and financial regulation theoretically bound at 0 and 1, where
 328 increasing values indicate increasing entropy—increasing uncertainty in the
 329 definition of the problem.

330 Our measure of the participation of federal bureaucrats is gleaned from
 331 our expansive data collection efforts on the witnesses appearing at congress-
 332 sional hearings on business and financial regulation. We count the number of
 333 federal bureaucrats appearing at congressional hearings on business and fi-
 334 nancial regulation as identified from the CAP archive of hearings. In addition
 335 to counting the number of federal bureaucrats appearing at these hearings,
 336 we collected the order in which these bureaucrats testified in relation to

⁵Entropy in the original Shannon formulation is often written $-\sum_{i=k}^k p * \log_k p$. Here, we use $\frac{1}{p}$ to eliminate the need for the negative sign in front

337 other bureaucrats and organized interests. Our second measure of bureau-
338 cratic participation pertains to the primacy of bureaucrats at the hearings,
339 in terms of the older social psychological research. We count the number of
340 bureaucrats each month in our analysis who testify first in the hearings.⁶

341 From this data set, we were able to generate a list of all federal bureaucrats
342 appearing at these hearings. Using this list, we were able to classify career
343 bureaucrats participating in the hearings by taking the names on the list and
344 cross referencing them with the *Plum Book* for each associated time period,
345 which allowed us to ascertain the job classification of each federal bureaucrat
346 (Senior Executive Service, political appointee, careerist, etc.) (Lewis, 2008).
347 By matching federal bureaucrats to the *Plum Book*, we obtained a count of
348 the number of career bureaucrats participating in hearings on business and
349 financial regulation over time.

350 Figure 2, panel (a) displays the count of federal bureaucrats appearing at
351 congressional hearings on business and financial regulation over the period
352 of study. The first thing to note is that the number of bureaucrats appearing
353 varies quite a bit from month to month. In general, bureaucrats appeared
354 in greater numbers during the George H.W. Bush and Clinton administra-
355 tions. Bureaucrats were less pervasive in the hearing process during the first
356 term of George W. Bush, however, these numbers would likely increase once
357 the financial crisis is taken into account. The mean number of bureaucrats
358 appearing in business and financial regulation across the monthly data is 16
359 with a standard deviation of 14. Participation ranged from 0 appearances
360 occurring more than once to 63 in March of 1984.

361 Fewer bureaucrats appear at hearings after Republicans take control of
362 Congress in 1995. The mean prior to 1995 is 20 bureaucrats per month, while
363 the mean afterward is 12 ($p < .001$ for a simple test of means). The period
364 after Republican control of Congress was generally prosperous economically
365 speaking as well, which likely contributes to the lower numbers of bureau-
366 crats. After all, fewer problems in the policy making environment implies less
367 need for bringing in bureaucrats to define those problems. Figure 2 displays
368 the frequencies of bureaucrats across party control of Congress in panel (b)
369 and presidential administration in panel (c). Figure 2, panels (b) and (c)

⁶The social psychological literature points not only to primacy (who speaks first), but also to recency (who speaks last) in the persuasiveness of information. While someone always testifies first, the length of testimonies (in terms of the numbers of individuals appearing) varies greatly, making it difficult to collect a systematic measure of recency.

Figure 2: Participation of Federal Bureaucrats in Business and Financial Regulation.

Panel (a) displays the frequency of federal bureaucrats appearing in congressional hearings on business and financial regulation each month from January 1983 through September 2005. Panel (b) displays the total frequency over the period broken out by party control in Congress ($\chi^2 = 50$, $p < .001$). Panel (c) displays the total frequency for the period broken out by presidential administration ($\chi^2 = 70$, $p < .001$).

370 show that there are significant differences in bureaucratic participation by
371 party control of Congress and by presidential administration.

372 Panel (c) of Figure 2 shows a higher number of bureaucrats appear un-
373 der the Clinton administration, probably as a result of ideology and also
374 the Republican takeover of Congress. The highest annual average of bu-
375 reaucratic appearances occur during the George H.W. Bush administration
376 (280 bureaucrats) and the lowest under George W. Bush (105 bureaucrats) .
377 Whether this was due to war or the economic woes of the late 1980s and early
378 1990s, Figure 2, panel (c) prevents a clear story of partisanship in presiden-
379 tial administration as a driver of bureaucratic participation in congressional
380 hearings. Panel (b) of Figure 2 also shows that democratically controlled
381 Congress's increase bureaucratic participation in the hearings. This makes
382 sense if one assumes that democrats are more apt to seek out problem def-
383 initions and solutions that favor a governmental role in the economy and
384 society.

385 Moving to congressional uncertainty about problem definitions, Figure 3
386 displays the relationship between bureaucrats at congressional hearings on
387 business and financial regulation and the entropy characterizing these hear-
388 ings. Figure 3 includes a lowess smooth line with 95% confidence interval
389 represented by the shaded area. The scatter plot of Figure 3 shows the re-
390 lationship to be positive and exponential.⁷ In general, Figure 3 is suggestive
391 of the relationship between congressional uncertainty, at least measured as
392 hearing entropy in days, and levels of participation by federal bureaucrats
393 in business and financial regulation. The hearing entropy and bureaucratic
394 participation correlate at .64 ($p < .001$). Hearing entropy also displays con-
395 siderable variation over the period under study. With a mean of .54 and
396 standard deviation of .25, its empirical range in this instance almost encom-
397 passes its theoretical range at 0 and .91. In other words, there are times in
398 the series where congressional attention is very focused on a few dimensions
399 of the problem, and is hence more certain about the nature of the problem.
400 This is balanced by periods where uncertainty is so prevalent as to rule the
401 day.

402 Figure 3 sets the stage for a more rigorous examination of the influence
403 of congressional uncertainty on the participation of federal bureaucrats in

⁷A plot of the logs of these two variables reveal a strictly linear relationship character-
ized by heteroskedasticity.

Figure 3: Congressional Problem Uncertainty and Federal Bureaucrats in Business and Financial Regulation.

The figure displays a scatter plot of the relationship between congressional hearing entropy and the participation of federal bureaucrats in business and financial regulation. The blue line displays a lowess smooth of the same relationship with bandwidth set at two thirds and includes a 95% confidence interval covered by the shaded area.

404 hearings on business and financial regulation. The figure is suggestive of the
405 causal influence of congressional uncertainty concerning problem definition
406 on the levels of participation by bureaucrats. The figure is also suggestive of
407 our approach to modeling this influence.

408 6. Modeling Bureaucratic Participation and Prominence

409 Our measure of bureaucratic participation is a count of federal bureau-
410 crats appearing in congressional hearings on business and financial regulation.
411 Since the measure is a count, its distribution contains properties making it
412 more amenable to statistical models tailored to count processes. In particu-
413 lar, the histogram of monthly counts of federal bureaucrats reveals the typical
414 distribution of a count variable, except it contains an excess of zeros (see Fig-
415 ures 2 and 3). This fact recommends hurdle or “zero-inflated” count models
416 as an appropriate statistical tool for modeling the influence of congressional
417 uncertainty on bureaucratic participation and prominence.

418 Zero-inflated count models are useful in modeling data in which zeros
419 can arise from 2 different processes. Zeros might arise as a product of the
420 same data-generating process leading to positive counts. Alternatively, zeros
421 could arise from a separate process. For example, the hearings on business
422 and financial regulation might lead to an absence of bureaucrats arising out
423 of greater certainty regarding the problem definition and a particular con-
424 figuration of political influences. Alternatively, an absence of bureaucrats
425 might also be due to an excess of hearings for purposes of bill mark-ups,
426 which often have no witnesses at all. This second process leading to a zero
427 has little to do with the underlying process generating the positive counts
428 (politics and the uncertainty surrounding the issue), but is instead a product
429 of the legislative calendar.

430 Zero-inflated count models address this distinction by allowing zeros to
431 arise from each of two separate models, which are combined to model data
432 exhibiting excess zeros. The models contain a binomial component (most of-
433 ten logit or probit), which models the “excess” zeros, and a count component
434 (usually poisson or negative binomial) to model the count process. After test-
435 ing zero-inflated models against standard count model specifications, it was
436 determined that the zero-inflated specification was a better approximation
437 to the data than were the standard models. In addition, the zero-inflated
438 negative binomial (ZINB) specification out-performed the zero-inflated pois-
439 son distribution as indicated by a Vuong likelihood ratio test comparing the

models. The log-likelihood for the general form of the model is as follows:

$$\ln \mathcal{L} = \begin{cases} \ln(p_i) + (1 - p_i) \left(\frac{1}{(1 + \alpha \mu_i)} \right)^{\frac{1}{\alpha}} & \text{for } y = 0 \\ \ln(p_i) + \ln \Gamma\left(\frac{1}{\alpha} + y_i\right) - \ln \Gamma(y_i + 1) - \ln \Gamma\left(\frac{1}{\alpha}\right) + \left(\frac{1}{\alpha}\right) \ln\left(\frac{1}{(1 + \alpha \mu_i)}\right) + y_i \ln\left(1 - \frac{1}{(1 + \alpha \mu_i)}\right) & \forall y > 0 \end{cases} \quad (1)$$

$$\mu = \exp(\mathbf{X}_i \beta) \quad (2)$$

In Equation (1), the excess of zeros is accounted for in the logit function when $y = 0$, while the counts are modelled in the negative binomial function for all $y > 0$. The α parameter accounts for the over-dispersion often characterizing count data. Equation (2) shows that the systematic component for the counts are modeled using $\mu = \exp(\mathbf{X}_i \beta)$, where $\mathbf{X}$ is the matrix of covariates in our model and β is a vector of estimated parameters. Of these, we are primarily interested in the effect of topic entropy on bureaucratic participation.

For an expeditious discussion below, we present results for the count components of the ZINB models only. We believe the particular process giving rise to the excess zeros (the binomial component) to be much more a function of institutional peculiarity and scheduling not easily addressed with our data. As such, the binomial component contains only the mean and our entropy measure.⁸ Second, it is the count component of the model in which we are interested, as it pertains directly to our hypotheses. Full model results for the ZINB specifications are available in Appendix A. We would merely note, however, that in each of the 3 full models presented in Appendix A, topic uncertainty is a robust and significant predictor in the logit equation. Each of these coefficients is signed negatively, indicating that when congressional topic uncertainty is high, instances where federal bureaucrats are absent significantly decrease. This is subtle and general support for our hypotheses in Section 4.

Figure 4 displays the regression results for the ZINB model of overall bureaucratic participation in congressional hearings on business and financial regulation. The regression estimates are presented as a “ropeladder” in Panel (a) of the figure. The parameter estimates also contain 95% confidence intervals showing the uncertainty around these estimates. The estimates, and

⁸We tested the other influences appearing below, none of which were useful in predicting the excess zeros.

468 their confidence intervals, are the result of 10,000 simulations of the model
469 and their standard deviations.⁹ The dependent variable in Panel (a) of Figure
470 4 is a monthly count of federal bureaucrats appearing at hearings on busi-
471 ness and financial regulation for the time period under study and pertains
472 to Hypothesis 1.

473 In addition to our measure of congressional hearing entropy, the model
474 contains binary variables for unified Republican and unified Democratic con-
475 trol of the institutions of government and legislative ideology measured in
476 the first dimension of Pool and Rosenthal's NOMINATE scores (Poole and
477 Rosenthal, 1997). In addition, we include a variable for party transitions in
478 Congress. We expect that unified Republican governments will decrease the
479 participation of federal bureaucrats, while unified Democratic governments
480 will increase their participation due to different preferences over the locus of
481 policy implementation with Republicans preferring private sector solutions.
482 Likewise, we expect increases in the NOMINATE score, indicating increased
483 conservatism, to be negatively related to bureaucratic participation. The
484 model also contains a variable for party transition in Congress. This variable
485 takes a value of one for each of the first six months following a change from
486 Republican to Democratic control or vice versa. This is because we expect
487 these transitions to lead to new efforts to redirect the general policy direction
488 of the bureaucracy. Finally, the model contains the percent of party unity
489 votes in Congress tabulated from data on polarization in Congress (McCarty,
490 Poole, and Rosenthal, 2006). The nominate scores and party unity data were
491 obtained from the web-site maintained by Keith Poole.¹⁰

492 Panel (a) of Figure 4 shows that the entropy associated with congressional
493 hearings on business and financial regulation does increase the participation
494 of federal bureaucrats in these hearings. Along with congressional uncer-
495 tainty, unified Republican government and increasing congressional conser-
496 vatism are associated with decreases in the number of bureaucrats partic-
497 ipating in the hearings. Unified Democratic control of government is also
498 associated with decreases participation by federal bureaucrats, although this
499 influence is barely statistically significant. The fact that the intercept in the
500 model, capturing the influence of divided government, is not statistically sig-

⁹In addition, we performed 1,000 bootstrapped simulations of the regression coefficients. These bootstrap estimates showed that no parameter estimate contained bias of greater than ± 0.005 .

¹⁰The data are made freely available by Poole at <http://voteview.com/>.

nificant (note that its confidence interval crosses zero) makes the influence of partisan control of government a bit harder to discern. The only solid conclusion is that fewer bureaucrats appear at the hearings under unified republican control. Party transition also fails to reach conventional levels of statistical significance.

Note that Figure 4 shows that increases in party polarization, measured as the percentage of party unity votes in Congress, are associated with increases in participation by federal bureaucrats. The estimate for party polarization is sizeable even though the confidence interval for the estimate is large. It is possible that the pitched political conflict within the chambers of Congress is in part manifested in efforts to steer the bureaucracy. However, even under party unity, one party holds majority status. It could also be the case that legislative conflict makes imperative the need to justify majority party stances with testimony from bureaucratic experts. Further, in preliminary analyses, the relationship between party unity votes and bureaucratic participation varied a great deal between the House of Representatives and Senate. It is possible that combining the measures contributed to the uncertainty surrounding its influence.

Panel (b) of Figure 4 contains the simulated influence of entropy in congressional hearings on business and financial regulation on the appearance of federal bureaucrats at these hearings. The figure was constructed by conducting 1,000 simulations of the influence of entropy on bureaucratic participation at each 0.01 of hearing entropy across its empirical range. The line represents the prediction of the model pursuant to these simulations and the shaded area represents the 95% confidence interval for each prediction, also a function of the 1,000 simulations of the model. As entropy increases across its range, there is a resulting increase of around 35 federal bureaucrats participating in the hearings. As mentioned above, entropy varies quite a bit. A similar plot containing simulations for a move in entropy from minus one standard deviation to plus one standard deviation yields an increase of around 20 federal bureaucrats. In general, Figure 4 supports the notion that increases in congressional uncertainty, at least measured in hearing entropy, are related to increases in the participation of federal bureaucrats in the issue of business and financial regulation. Figure 4 offers substantial support for Hypothesis 1 concerning bureaucratic participation.

Figure 5 displays the same statistical model for bureaucratic primacy in congressional hearings. The dependent variable in Panel (a) of Figure 5 is a monthly count of the number of bureaucrats testifying *first* at congressional

(a) Participation in Congressional Hearings.

(b) Hearing Entropy and Predicted Federal Bureaucrats.

Figure 4: Congressional Uncertainty and Federal Bureaucrats in Business & Financial Regulation.

Panel (a) contains the estimates for the count process of a zero-inflated negative binomial regression of the number of federal bureaucrats participating in congressional hearings for the count process in the model. Estimates and 95% confidence intervals are the product of 10,000 simulations. Panel (b) contains the simulated influence of hearing entropy on the number of bureaucrats appearing in hearings on business and financial regulation. These predictions are the product of 1,000 simulations at each 0.01 of hearing entropy across its range. The panel includes 95% confidence intervals for the predictions.

539 hearings on business and financial regulation. Given increased uncertainty,
 540 we expected that bureaucrats would not only participate in greater num-
 541 bers as shown by Figure 4, but also that their prominence, here measured
 542 as primacy, in the hearings would increase as Congress struggled to define
 543 the issues. As with bureaucratic participation, Panel (a) of Figure 5 shows
 544 that congressional uncertainty is positively, and significantly, related to in-
 545 creases in the primacy of federal bureaucrats at hearings. The coefficient is
 546 only slightly smaller, but remains robust. Consistent with bureaucratic par-
 547 ticipation, unified Republican control of government seems to lead to lower
 548 bureaucratic primacy in the hearings. While the impacts of congressional
 549 ideology and unified democratic control of government are not statistically
 550 distinguishable from zero, the influence of polarization in Congress and party
 551 transitions seem to increase bureaucratic primacy. Party transitions barely
 552 exceed the requirements for statistical significance at the conventional 95%
 553 level. And while the confidence interval around polarization remains quite
 554 large, its parameter estimate is of larger size, making its positive influence on
 555 bureaucratic primacy more certain. While changes in the party in power in
 556 Congress do not seem to increase the participation of federal bureaucrats, it
 557 possibly brings them front and center in policy debates in business and finan-
 558 cial regulation. Likewise, increased legislative conflict seems to increase the
 559 prominence of federal bureaucrats in policy debates, wanted or not. While
 560 bureaucrats are often viewed with disdain in popular images of government,
 561 bureaucrats are quite often marshalled to lend legitimacy to political claims,
 562 whether made by politicians or organized interests, especially where the bur-
 563 dens of evidence are high.

564 Panel (b) of Figure 5 shows a similar plot of predicted primacy as in the
 565 model for bureaucratic participation. Again, the point estimates forming
 566 the line and the shaded area representing the 95% confidence interval are the
 567 result of 1,000 simulations at each 0.01 of hearing entropy across its empirical
 568 range. Panel (b) shows that as hearing entropy moves over its range, there is a
 569 resulting increase of about 16 federal bureaucrats testifying first in hearings
 570 on business and financial regulation. A similar plot of predicted primacy
 571 resulting from a shift from minus to plus one standard deviation results in
 572 an increase of six bureaucrats testifying first at the hearings. The monthly
 573 mean of federal bureaucrats testifying first is eight, with a range of zero
 574 and 34. Figure 5 is in general supportive of the notion that congressional
 575 uncertainty not only increases bureaucratic participation in the hearings,
 576 but also increases the prominence of these bureaucrats in the policy debate.

Figure 5: Problem Definition and Bureaucratic Primacy in Congressional Hearings.

Panel (a) contains the estimates for the count process of a zero-inflated negative binomial regression of the number of federal bureaucrats testifying first in congressional hearings on business and financial regulation. These estimates are the product of 10,000 simulations and include 2 standard deviation (95%) confidence intervals for the estimates. Panel (b) contains the simulated influence of hearing entropy on the number of bureaucrats testifying first in hearings on business and financial regulation. These predictions are the product of 1,000 simulations at each 0.01 of hearing entropy across its range. The panel includes simulated 95% confidence intervals for the predictions.

577 This is suggestive of the role played by federal bureaucrats, especially under
578 conditions of extreme uncertainty, in shaping the development of working
579 problem definitions. It further suggests that federal bureaucrats not only
580 implement policies and represent constituent or client group interests, they
581 are central in structuring the resulting policy debates. In doing so, they lend
582 legitimacy to some claims and de-legitimize others. Figure 5 offers support
583 for Hypothesis 2 concerning bureaucratic primacy.

584 If bureaucratic participation and prominence increase under congressional
585 uncertainty for the reasons outlined above, it should be the case that con-
586 gressional uncertainty increases the levels of participation not only of bu-
587 reaucrats in general, but particularly of career bureaucrats. We have argued
588 that a concern for reliable information with a very low variance even if a
589 little biased helps fuel congressional demand for bureaucratic participation
590 in policy making. Careerists in the federal bureaucracy likely hold an edge
591 not only on organized interests, but also on their superiors at the apex of

592 the bureaucracy in this regard. Shielded from exposure to intense political
593 pressure, unlike their peers at the top of the bureaucracy, careerists likely
594 provide a more consistent and reliable source of information than their coun-
595 terparts. Given this, their participation under conditions of uncertainty is
596 vital even if their expertise is biased. Their longevity fosters the ability of
597 members of Congress to weight their expertise in a way not possible with
598 organized interests or political appointees. The mean number of careerists
599 participating monthly in hearings on business and financial regulation in the
600 time period under study is 4.7 (standard deviation of 4.5), with a range of
601 zero and 24. Levels of participation by careerists are especially sensitive to
602 uncertainty at its higher levels.

603 Figure 6 displays the same analysis of participation by career bureau-
604 crats in business and financial regulation as for general levels of bureau-
605 cratic participation and primacy in the two previous figures. It supports
606 generally the arguments underlying Hypothesis 3 concerning topical uncer-
607 tainty and participation by career bureaucrats. The dependent variable in
608 Panel (a) of Figure 6 is the monthly count of career bureaucrats appearing
609 at congressional hearings on business and financial regulation. Once again,
610 congressional hearing entropy is associated with increases in careerist par-
611 ticipation in business and financial regulation. Along with hearing entropy,
612 unified Republican government decreases levels of participation by careerists.
613 As well, polarization in Congress increases participation by careerists, albeit
614 with a sizeable confidence interval. Panel (b) of Figure 6 displays the pre-
615 dicted counts of federal career bureaucrats as hearing entropy varies across
616 its range. Again, both these point estimates represented by the line, and
617 95% confidence interval represented by the shaded area are the result of 1000
618 simulations at each 0.01 of entropy through its range. Panel (b) predicts an
619 increase of around 10 careerists as entropy traverses its range. A similar
620 plot of predicted counts as entropy moves from minus to plus one standard
621 deviation predicts an increase of about 5 career bureaucrats at the hearings
622 on business and financial regulation.

623 Confronting problems rife with uncertainty, the findings of Figure 6 high-
624 light the importance of volatility and variance in political and policy decision
625 making. Especially under uncertainty, it is not enough that the stream of
626 communication from relevant participants provide information. The infor-
627 mation also must be characterized by consistency and reliability, if only for
628 a point of reference in a volatile decision making environment. To the degree
629 that careerist bureaucrats represent consistency in the system of governmen-

Figure 6: Problem Definition and the Prominence of Career Bureaucrats.

Panel (a) contains the estimates for the count process of a zero-inflated negative binomial regression of the number of career federal bureaucrats participating in congressional hearings on business and financial regulation. Estimates are the product of 10,000 simulations of the model and include two standard deviation (95%) confidence intervals. Panel (b) contains the simulated influence of hearing entropy on the number of career federal bureaucrats participating in hearings on business and financial regulation. These predictions are the product of 1,000 simulations at each 0.01 of hearing entropy across its range. The panel includes simulated 95% confidence intervals for the predictions.

tal communication, these analyses highlight the need for research to be more attentive to variability in choice situations.

7. Discussion and Conclusions

Taken together, the models presented are supportive of the notion that Congress tends to rely more heavily on federal bureaucrats when faced with increasing uncertainty about the nature of problems, at least in the important issue of business and financial regulation. As uncertainty about the most relevant topical dimensions of the issue increase, federal bureaucrats are called to participate in greater numbers. Further, these bureaucrats are often in prominent positions within the hearing process, testifying first, setting the agenda, and perhaps structuring the policy debate. Finally, not only do bureaucrats in general participate in greater numbers, but careerists, likely those best positioned to reduce uncertainty, participate in numbers that far

643 outstrip their usual involvement.

644 The theorizing and analysis presented here draws attention to three facets
645 of congressional search and the information supply by the federal bureau-
646 cracy. First, the findings are supportive of the notion that difficulty in defin-
647 ing problems, and developing working understandings, is a prime considera-
648 tion for members of Congress when engaging in search processes. Members
649 of Congress do not micro-manage bureaucrats, but neither are they left at
650 their mercy when it comes to information provision. While dependent on
651 information from bureaucrats, interest groups, academics, and experts of all
652 types, the analyses strongly suggest that members of Congress, working in
653 committee especially, are able to navigate this uncertainty and craft flows
654 and blends of information that allow for adaptable policymaking.

655 Second, the analyses highlight the valuable role of the federal bureaucracy
656 in generating information, shaping problem definitions, and influencing pol-
657 icy agendas (Workman, 2015). Far from mere implementers of legislation,
658 court decisions, and presidential directives, bureaucrats are influential at the
659 agenda setting and problem definition phase of the policy process. This
660 front-end role of bureaucracy in the system of information processing has
661 been under-appreciated in the literature.

662 Third, the analyses point to the important distinction between informa-
663 tion pertaining to positions versus information pertaining to problems. The
664 prominence of careerists in instances of topical uncertainty suggests that
665 members of Congress are sensitive to this distinction, seeking out careerists
666 when problems call for consistent, reliable sources of information. The dis-
667 tinction between the problem and solution space of issues is also vital. Where
668 solutions and preferences are settled, or where solutions wholly define their
669 problems, we expect bureaucrats to recede in importance and prominence.

670 Overall, this research furthers our understanding of the system of informa-
671 tion processing that characterizes the administrative state. Issue dynamism
672 and the rise of boundary-spanning policy problems increasingly means the
673 locus of expertise necessary to address problems lies between the traditional
674 boundaries of subsystems and legislative jurisdictions. Given this, under-
675 standing how congressional search and bureaucratic information supply in-
676 tersect is increasingly important as bureaucracies are brought into compe-
677 tition with one another and members of Congress are faced with a need to
678 blend information to craft novel problem definitions that can handle these
679 types of issues.

680 More practically, we collected 25,681 witnesses appearing in 4,019 days of

681 congressional hearings on business and financial regulation. This represents
 682 a tremendous investment in resources to explore the mobilization of federal
 683 bureaucrats within this policy area. Understanding mobilization in any one
 684 issue area requires this sort of investment. There are some limitations of
 685 the analyses presented. Many of the political variables presented pertain to
 686 macro dynamics at the broadest level. Politics at the committee level would
 687 likely be a profitable extension of this research (Shafran, 2015).

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781 **Appendix A. Full Model Results**

Table A.1: Congressional Uncertainty and Bureaucratic Participation in Business Regulation

	Count		Zero Inflation	
	Estimate ^a	St Error	Estimate	St Error
Intercept	0.39	0.43	1.15	0.42
Congressional Uncertainty	2.72	0.23	-9.60	1.62
Unified Republican	-0.45	0.14		
Unified Democratic	-0.34	0.16		
Congressional Ideology	-0.53	0.17		
Party Transition	0.05	0.12		
Party Unity (Polarization)	1.53	0.73		
Overdispersion (θ)	3.95	1.13		
N	273			
AIC	1800			
- Log Likelihood ^b	-890			

^a The table displays the results of a zero-inflated negative binomial model for counts of federal bureaucrats per month from January 1983 through September 2005.
^b Vuong tests comparing the ZINB specification of to zero inflated poisson (ZIP) and negative binomial specifications yielded test statistics of 7.56 ($p < .001$) and 3.78 ($p < .001$) respectively suggesting that the ZINB specification is the best fit to the data.

	Count		Zero Inflation	
	Estimate ^a	St Error	Estimate	St Error
Intercept	-0.33	0.48	2.01	0.58
Congressional Uncertainty	2.38	0.28	-12.62	2.30
Unified Republican	-0.36	0.15		
Unified Democratic	-0.05	0.17		
Congressional Ideology	-0.03	0.18		
Party Transition	0.26	0.13		
Party Unity (Polarization)	1.99	0.78		
Overdispersion (θ)	3.93	1.15		
N	273			
AIC	1499			
- Log Likelihood ^b	-740			

^a The table displays the results of a zero-inflated negative binomial model (ZINB) for counts of federal bureaucrats per month from January 1983 through September 2005.

^b Vuong tests comparing the ZINB specification of to zero inflated poisson (ZIP) and negative binomial specifications yielded test statistics of 4.71 ($p < .001$) and 3.67 ($p < .001$) respectively suggesting that the ZINB specification is the best fit to the data.

Table A.3: Congressional Uncertainty and Career Bureaucrats in Business Regulation

	Count		Zero Inflation	
	Estimate ^a	St Error	Estimate	St Error
Intercept	-0.59	0.61	1.14	0.51
Congressional Uncertainty	2.27	0.34	-9.30	1.70
Unified Republican	-0.46	0.19		
Unified Democratic	-0.25	0.21		
Congressional Ideology	-0.23	0.22		
Party Transition	-0.31	0.17		
Party Unity (Polarization)	1.99	0.98		
Overdispersion (θ)	2.68	1.2		
N	273			
AIC	1379			
- Log Likelihood ^b	-679			

^a The table displays the results of a zero-inflated negative binomial (ZINB) model for counts of federal bureaucrats per month from January 1983 through September 2005.

^b Vuong tests comparing the ZINB specification of to zero inflated poisson (ZIP) and negative binomial specifications yielded test statistics of 4.80 ($p < .001$) and 2.3 ($p < .02$) respectively suggesting that the ZINB specification is the best fit to the data.