The Population Ecology of Interest Groups and Counter-Mobilization: Reproductive Rights Organizations in the United States, 1920-1985

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Abstract

This research letter builds upon a number of important articles published in a variety of outlets concerning the population ecology of interest groups. Importantly, Lowery and Gray (1995), Nownes (2004) and Nownes and Lipinski (2005) empirically demonstrated the dependence on the density of pre-existing, similar groups when predicting new group formations. In this letter I add to this research by modeling the density of ideologically divergent reproductive rights groups as well as offer supporting evidence for the popular *Energy-Stability-Area* model. The former is a novel consideration in the field of population ecology which primarily examines ideologically similar groups. I show that density dependence is at play among these polarized groups. I also provide insight into counter-mobilization movements of group formation by empirically demonstrating which groups are initial movers versus reactionary formers. In doing so, I raise important questions for researchers concerned with the emergence, longevity, and impact of interest groups over long periods of time. Finally, this research sheds light on the expectations of group behavior in light of the landmark *Dobbs* decision.

Keywords

Population Ecology • Density Dependence • Representation • Interest Groups •Reproductive Rights

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Introduction

There is no simple answer as to why interest groups form when they do (Anzia 2011; Disch 2021). Classical schools of thought seek explanations at the micro-level: what compels an individual to enter into collective endeavors? Olson (1965) thoroughly engaged the question of "the logic of collective action" by investigating "free-riders" in a rational choice framework. Exchange theories, like those popularized by Salisbury (1969), suggest that group leaders must provide incentives to spur activity. Despite their utility, these theories fail to consider some important realities. For example, unlimited population growth (i.e., growth in the number of organizations) is not likely even if other barriers to growth are overcome. Lowery and Gray (1995) examine that reality in their seminal study on the organizational ecology of political groups. Their evidence for density dependent growth was compelling and continues to shape the study of political communities in the following decades.

Like groups are inherently competing for space in a universe with finite resources. Density dependence tells us that at the onset of group formation, when resources are plentiful, explosive proliferation is likely. This assumes that all groups within an interest space are competing for similar resources. Consider, for example, anti-abortion groups in the United States which are united around a single issue. I review the current literature on these groups in the forthcoming sections. These studies, however, often fail to consider the impact on resources that competing groups have.[1] The growth, effectiveness, and inherent competition of ideologically opposed groups is an important consideration when examining trends in a given interest space. There is no theoretical reason to think that group formation is not reflexive to competitor growth. In this letter, I demonstrate the importance of "interspecific

[1]Game theorists have long noted the importance of other teams in decision-making frameworks. In fact, "[f]or most applications of game theory, each 'player' of the game is actually a team of players" (Kim et al. 2022, 1). This paper is not an exercise in formal theory, but empiricists are apt to consider long-accepted principles from the field.

competition" in the interest universe; especially with regard to population ecology. I find that the growth of ideologically opposed organizations can be a better predictor of interest group formation than a more traditional, "intraspecific" model of density dependence. I also find that density dependent models achieve utility in determining the extent to which group formation is a factor of initial vs. counter-mobilization.

Population Ecology in Political Science

Interest group formation is an important area of study in the field of political institutions – these groups are an influential part of our political system but their attributes are considerably more opaque than other institutions like Congress. Trying to explain how and why interest groups form has challenged political scientists for decades. Initially, explanations were rooted at the micro-level of membership growth. Phrases like exchange theory (see e.g., Salisbury 1969) and "the logic of collective action" (see e.g., Olson 1965) come to mind. While useful, these theories were introspective and did not adequately address external factors. Lowery and Gray (1995) added to the formation literature by integrating density dependence theory which is rooted in traditional studies of population ecology (Lotka 1925; Volterra 1926). They demonstrated that group growth was dependent on the abundance of similar groups. At the outset of population growth, formation encourages more formation until a carrying capacity is reached. At that point the relationship inverts itself (Hannan and Freeman 1977). Following this logic, Nownes and Lipinski (2005) showed that interest group dissolution can be explained with the opposite pattern. Lowery and Gray (1995) focused on modern, general interest group populations in the states, but subsequent studies have offered similar evidence for group types ranging from left-leaning activist (Nownes 2004) to right-leaning religious (Hightower 2021) organizations. The principal findings also hold in international contexts (Fisker 2013) and over large periods of time (Chamberlain et al. 2019).

In addition, these studies provide a useful empirical context to the study of interest groups which is often cross-sectional in nature (Holyoke 2019).

Admittedly, though, density dependence is a "blunt instrument" (Nownes and Bell 2018, 62) and has not accounted for competition with competitor groups despite the fact that concurrent biological studies have been taking this into account for some time (Adler et al. 2018). Here, "competitor groups" refers to associations that operate in pursuit of opposing goals. I address this gap in the literature on group emergence and competition by using the same basic principles of density dependence. However, I theorize that groups are not only density dependent upon like groups but also competitor groups with opposing goals. I find that among abortion-rights and anti-abortion groups, growth and density in the opposing groups is a better predictor of formation than internal density. I also show that the strength and sign of the covariates can lend explanatory power to the reactivity among counter-mobilizing groups. However, an additional finding in this letter is a practical one: competitive group growth matters, and I highlight the importance of accounting for that growth in population ecology studies.[2]

The Problem and Case Selection

To model competition in this way, I identify two types of groups that presumably compete for the same resources. By accomplishing this, many of the operationalization issues in group formation studies are alleviated. I need not specifically define what those resources are (see especially, Halpin 2015; Hannan and Freeman 1977; Lowery and Gray 1993; 1995; Nownes and Lipinski 2005), just that they likely compete for them. This is no small task. While it

[2]For a discussion on lobbying and population ecology, see Braun (2015).

is easy to identify groups that oppose one another ideologically, it is difficult to find large subsets that would theoretically compete for the same resources. Consider, for example, environmental preservation groups. They operate under a moral obligation to protect the planet. However, their primary opponents, fossil fuel corporations, are *not* operating under a moral obligation to destroy the environment. Their goal, rather, is an economic one.

An apropos subsection of interests are reproductive rights. Abortion-rights and anti-abortion[3] groups, for all intents and purposes, have opposite goals. Yet, they reasonably compete for similar resources. One may be tempted to define conceptualize resources as potential members, information, or moneys raised; however, doing so is beyond the scope and capability of population ecology techniques. Other studies outside of population ecology do this quite well (Chin et al. 2000; Heitshusen 2000; Lohmann 1998). However, in this case, it is sufficient to assume that there is overlap in resource seeking behavior. Consider the end goals of each side. Abortion-rights groups seek a society where abortions are accessible. Anti-abortion groups seek an abortion-free society. Achieving either of these goals would mean 100% agreement within the American political system.

One might assume that there is little room for competition on such a polarizing issue. Abortion has become increasingly partisan (Adams 1997). However, while it is divisive, American public opinion is not so clear cut (partisanship itself can often be a greater driver of political behavior than ideology (Lee 2009; Mason 2018). Recent polling makes this apparent. Only 33% of Americans are in favor of total legalization or prohibition of abortion leaving the majority 67% somewhere in the middle ideologically (Jones et al. 2011). Further significant variation exists on the question of the morality of abortion among younger

[3]This terminology is used in guidance with *The Associated Press Stylebook* (2022) in place of more colloquial terms like "pro-life" or "pro-choice."

generations (Jones et al. 2011; Rouse and Ross 2018). Federal legislators also often exist in a gray space ideologically. They "can be pro-choice but, in personal matters, choose life or can be pro-choice but support parental notification laws for minors. Likewise, one can be antiabortion [sic] but approve of stem cell research. Absolute clarity... is simply not inherent" (Ainsworth and Hall 2011, 179). It should be no surprise that reproductive rights organizations continue to flourish and advocate for changes in laws, compete to educate the public, and sway public opinion. Both types have been involved in voter mobilization, lawsuits, education, etc. Naturally there is variation in their behavior, but their diametric opposition makes them the perfect case of interspecific competition to study.

Theory

Traditional models of interest group formation (e.g., exchange theory) tell us a lot when we are able to operationalize the measurement of their resources. However, these theories lose explanatory power when benefits are not apparent, membership data is inaccessible, financial disclosures are sealed, and/or similar groups are offering different incentives. Exchange theory also does not address the fact even with unlimited resources, unlimited growth is not likely. Population ecology assuages these issues by assuming that all groups take up roughly equal space in the universe and are competing for some resource and pinpoints the point at which growth is no longer possible: a critical mass. This maximum number of groups is reached at some time point t. Considering the population of groups is often defined as the area term in Gray and Lowery's *Energy-Stability-Area* (ESA) model (Holyoke 2021). Because my data are structured as occurrences and an accruing total, I test the following, traditional density dependent hypotheses in what follows:

H_1:The number of existing abortion-rights(anti-abortion) groups positively correlates with

the number of abortion-rights(ant-abortion) group formations until a critical mass is reached at which point the relationship inverts.

Organizational ecology is dependent on count models for analysis. Its biggest benefit is its simplifying assumption of equality within a particular interest space – there is considerable difficulty in measuring groups theoretically (i.e., defining resources) and practically (i.e., collecting data). If all groups are assumed to be of the same size and influence in their effect on the formation of new groups, scholars can generalize findings at the cost of discounting the fact that some groups are going to be more influential than others. Nevertheless, the benefits of this simplifying assumption far outweigh the costs. To date, this approach has been widely applied to studies of groups situated similarly on the ideological spectrum, but it remains applicable for opposing groups despite the lack of attention in the literature. Growth in an interest space is necessitated by competitive group growth. If there was no competition, there would be few or no instances of opposing group proliferation. For this reason, I believe that anti-abortion groups are just as likely to be density dependent on abortion-rights groups as they are on other anti-abortion groups. Abortion-rights groups would exhibit a similar pattern. This is reflected in my second, primary hypotheses:

H_2: The number of existing abortion-rights(anti-abortion) groups will correlate with the formation of new anti-abortion(abortion-rights) groups and vice versa.

If density is critical to understanding counter-mobilization, and serves as the area term, the other facets of the ESA model – energy and stability – should also be considered. Energy is "the intensity of desire potential group members have to utilize... resources for engaging in advocacy, and 'Stability' [is] the durability of the larger political system from disruptive change that might threaten the existence of mobilized organizations" (Holyoke 2021, 266-7). For testing here, I adopt Holyoke's (2021) argument that the energy term may be appropri-

ately captured by the relative education of the populace. Traditionally, the energy term is an encouraging (i.e., positive) factor in population ecology studies. However, because abortion rights tended against the status quo in the time period studied, and the majority of policymakers and their constituents were of a specific demographic, I expect that increasing education levels will discourage group formation. This expectation, however, is gendered which is reflected in my third hypothesis:

H_3: The share of the male population with bachelor's degrees will negatively correlate with the formation of reproductive rights groups while the share of the female population will positively correlate with them.

Finally, the stability term can also be conceptualized as a "need" or "supply" of something sustaining groups. For reproductive rights groups, the number of abortions performed each year directly addresses this need for groups. This yields my fourth, final hypothesis:

H_4: The annual abortion ratio will positively correlate with the formation of reproductive rights groups.

Data

To test the density dependence hypotheses, I used entries in the *Encyclopedia of Medical Organizations and Agencies* (Kruzas et al. 1987) to create a dataset of the number of reproductive rights.[4] The encyclopedia covered the period from 1920-1985. Of the 310 entries listed, I identified 103 organizations that 1) fell under the umbrella category of "family

[4]Scholars are currently examining ways to automate this process to reduce error (see especially, Garlick and Cluverius 2020). However, the current method deals only with widespread sectors not granular enough to capture reproductive rights-specific groups.

planning" and 2) engaged in advocacy, education beyond patient consultation, and/or direct lobbying. If the foundation year was missing, I defaulted to the official website of the group. If regional offices for a group acted independently from a national umbrella group (i.e., maintained their own staff and self-direct their activities), they were counted as a separate entity.[5] I also utilized historic abortion rates compiled by Johnston (2021). While organizational data would ideally be current through the time of publication of this article, intensive research revealed a lack of contemporary sources that did not severely undercount historic anti-abortion groups. A comparison table of the investigated sources (including the popular *Associations Unlimited* database) and their organizational counts, demonstrating the robustness of the chosen source, is included in the online appendix. To minimize error, I chose to analyze more complete historical data in lieu of contemporary counts with reliability concerns. While this is a practical issue, it does allow for conclusions to be drawn about a period in which abortion attitudes were markedly less partisan (Cook et al. 1992) bolstering the importance of other factors on group formation.

Figure 1 displays graphically the growth of abortion-rights and anti-abortion groups. While abortion-rights groups have been around longer with greater numbers, they exhibit similar patterns. *Roe v. Wade* is marked by a dotted line. Abortion-rights groups began to proliferate in the 1920s and steadily grew through the 1980s. Their sharpest increase in foundations, however, was centered immediately before, during, and after *Roe* – when abortion rights were arguable more salient than ever before, and the status quo on reproductive health were restrictive/prohibitive laws. Unsurprisingly, because the status quo favored their position, foundations of anti-abortion groups are much more tightly focused around the landmark case. Figure 1 also displays similar increases in growth in the 1970s which we would not expect if there was little to no group competition.

[5]For example, Planned Parenthood in the states.

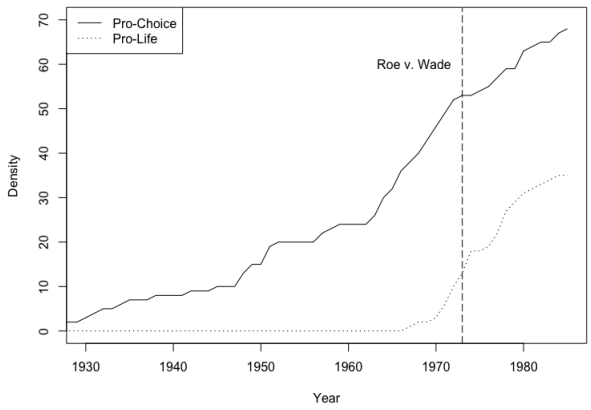

Figure 1

For the energy term of the ESA model, I used the U.S. Census Bureau's data on educational attainment by sex for the years in which it was collected. For missing years (e.g., those between censues), I imputed the data by simple linear interpolation.[6] The stability term was defined as the annual abortion ratio compiled by (Johnston 2021).

Testing and Results

Because each model is a count, I deploy negative binomial regressions.[7] In each of the models, the creation of groups or "foundings" is the dependent variable. The independent variables are: *Anti-Abortion* and *Anti-Abortion Sq.* representing the running count of anti-abortion groups, *Abortion-Rights* and *Abortion-Rights Sq.* representing the running count of abortion-rights groups, the *Abortion Ratio* relative to live births, the percentage of *Male BA Degrees* and *Female BA Degrees*. The results are displayed below in Table 1.

[6]The share of women earning bachelor's degrees in 1920 was manually calculated based off the estimate that they represented ≈30% of those awarded (Chamberlain 1988).

[7]A question may arise here about the utility of a 'hazard' or duration model. Because the groups in my data do not experience any significant level of death or dissolution – a necessary condition to warrant the use of a hazard model (see e.g., Ergon et al. 2018; Nownes and Lipinski 2005; Zucker 1989), a count model is still the most appropriate theoretically.

Table 1

	DV: Group Formation	
	Anti-Abortion	Abortion-Rights
	(1)	(2)
Anti-Abortion	0.113	-0.609^{**}
	(0.258)	(0.299)
Anti-Abortion Sq.	0.003	0.013^{***}
	(0.006)	(0.005)
Abortion Rights	1.181^{*}	0.283^{**}
	(0.640)	(0.118)
Abortion Rights Sq.	-0.011^{*}	-0.001
	(0.006)	(0.001)
Abortion Ratio	0.001	0.018^{*}
	(0.012)	(0.011)
Male BA Degrees	-1.122	-0.520^{**}
	(1.296)	(0.238)
Female BA Degrees	0.293	-0.387
	(1.256)	(0.391)
Constant	-18.473	1.611
	(15.318)	(1.236)
Observations	66	66
Log Likelihood	-27.960	-74.953
θ	25,229.360 (528,093.700)	13,587.290 (212,777.800)
Akaike Inf. Crit.	71.920	165.907

Note: *p<0.1; **p<0.05; ***p<0.01
Negative binomial regression with standard errors in parentheses.

H_1 is a straightforward hypothesis that density dependence is present in reproductive rights organizations. Each model contains terms for the density of groups within the same ideological orientation. Model 1 for anti-abortion groups fails to gain any statistical significance for these terms. However, Model 2 shows that abortion-rights groups are density dependent. Their formation is encouraged by an increasing population of other *Abortion-Rights* groups but also exhibits a carrying capacity as denoted by the negative coefficient associated with *Abortion-Rights Sq.*. These effects are significant at the .01 level. So, H_1 gains strong statistical support for abortion-rights but not anti-abortion groups.

While anti-abortion group formation is not encouraged by similar groups proliferating, they are highly encouraged by the formation of abortion-rights groups. This is denoted by the positive coefficient for *Abortion Rights* and negative coefficient for its square in Model 1. These estimates are significant at the .1 level. This lends support to H_2 and the directionality of the coefficient suggests that anti-abortion groups are counter-mobilizing, not first movers. The reverse relationship is found in Model 2, abortion-rights groups are discouraged from forming in the presence of increasing anti-abortion groups, though to a much lesser degree. These results are significant at the .01 level indicating stronger support for H_2. In addition, the findings for abortion-rights groups are consistent with the expectations of the ESA model. The predicted probabilities associated with H_2 can be seen in Figures 2 and 3 below.

H_3 which addresses the energy term of the ESA model considers the impact of education on bachelor degree attainment and group formation. Neither male or female degree outcomes gain statistical significance for anti-abortion groups in Model 1. However, the percentage of *Male BA Degrees* does negatively correlate with the formation of abortion-rights groups and is significant at the .05 level. The percentage of *Female BA Degrees* failed to gain

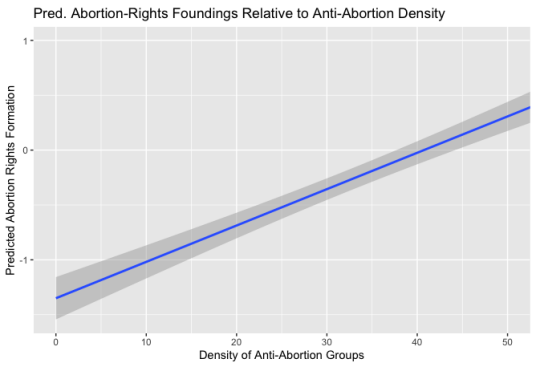

Figure 2

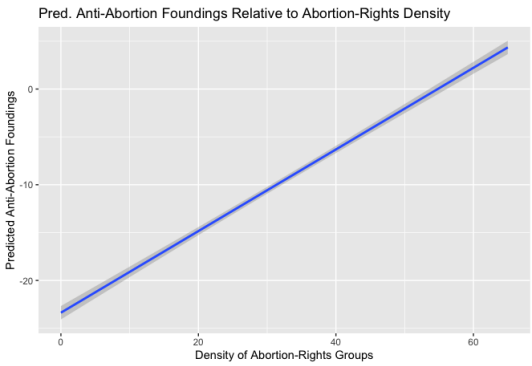

Figure 3

statistical significance. H_3 therefore gains modest support, but only among abortion-rights groups. Similarly, the *Abortion Ratio* gains statistical significance only in Model 2 which does support H_4 – that the demand for abortions is important to group formation. This effect is significant at the .1 level.

In summary, the results most strongly support H_2 which is also the most important theoretical contribution of this research note. Reproductive rights groups are heavily dependent on the increasing proliferation of competitor groups. For abortion-rights groups, this relationship is negative. This lends empirical support to the historical observation that they have began forming earlier as challengers to the status quo. For anti-abortion groups, this relationship is positive signifying their status as counter-mobilizers. This again lends empirical support to longstanding qualitative observations (Blanchard 1994; 1996; Feldt 2004; Munson 2008). While the results do not lend evidence to the ESA model being present among anti-abortion groups, they do for abortion-rights groups. The specific energy, stability, and area terms being operationalized in H_3, H_4, and H_1, respectively.

Conclusion

Interest groups matter (Miler 2018; Phinney 2016; Schlozman 1984) and we should care about their causes of formation. Population ecology offers an attractive method of study for interest group formation, proliferation, competition, and death because it does not depend on inaccessible resource specification. Seminal studies in density dependence of political organizations have focused on intraspecific competition and reveal that groups do not exist in a vacuum (and should not be studied as such), but rather are part of a dynamic environment where one group's fate is tied to the existence of other groups. My findings in this paper bolster that field of research but also introduce a new, important consideration: interspecific competition. I find that reproductive rights organizations, both anti-abortion and abortion-rights, have grown considerably in number over the past century. They are not only dependent on the density of their own organizations, but they are both effected by the growth of the other. For anti-abortion organizations, this relationship is reactionary. Growth in abortion-rights organizations encourages anti-abortion group formation. For abortion-rights organizations, the opposite is true. Further, the popular *Energy-Stability-Area* model pioneered by Lowery and Gray (1995) gains robust support in testing among abortion-rights groups.

Modeling density dependence between ideologically divergent groups is a step toward a more cohesive theory of competition. While the carrying capacity of an interest space is generally static (Lowery and Gray 1995), a massive political shock does have the ability to alter it. For example, the recent decision in *Dobbs v. Jackson* (2022) has that potential. If the historical findings in this research hold, we would expect to observe growth in abortion-rights groups met with an appropriate counter-mobilization of anti-abortion groups in the near future. Politics is often characterized by conflict and give-and-take relationships. In order

to better understand interest group formation and their efficacy (McKay 2012; Schlozman 1984; Strolovitch 2006; You 2017), we must understand how competing groups affect one another. Future research into group populations should consider this type of competition in concert with other resource-based questions (e.g., funds raised). While the findings here may not be generalizable to all issue spaces, the highly ideological nature of abortion likely moderates the effect compared to other less polarizing issues. Future scholars should consider this possibility across a broad range of issues (see e.g., Grossmann et al. 2021).

Compliance with Ethical Standards

On behalf of the author(s), the corresponding author states that there is no conflict of interest.

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Supplementary Material[8]

In the course of drafting this paper, I also used a number of other methodological tools as robustness checks and for exploratory purposes. In this section, I detail those methods along with some theoretical considerations not suitable for inclusion in the main text:

Other Organizational Reference Sources

There may be some questions to the robustness of the *Encyclopedia of Medical Organizations and Agencies* in regard to overcounting abortion-rights groups and undercounting anti-abortion groups. Intensive research, however, revealed this to be the most comprehensive listing of reproductive rights organizations since the birth of the issue space. Other popular directories, like *Associations Unlimited* (formerly known as the *Encyclopedia of Associations*), have severe data limitations given their publication year. Namely, omission of early organizations. Despite over 35 years of organizational development between the *Encyclopedia of Medical Organizations* and *Associations Unlimited* data, the latter only lists marginally more organizations (and is heavily biased toward those founded in the 1990s or later). Preliminary searches of several other sources revealed similar issues. The table below is an estimate of the total number of organizations listed by each source. Note that the search terms for *Associations Unlimited* were "abortion" and "pro-choice."

Comparison of Organizational Listing Sources Counts

Source	Year	Abortion-Rights	Anti-Abortion
Encyclopedia of Medical Organizations and Agencies	1987	68	35
Associations Unlimited	2023	83	43
The Making of Pro-Life Activists	2002	-	21
The Anti-Abortion Movement	1996	-	45

Additional research on web-based databases, including many that advertised themselves as "Pro-Life" had sparse organizational listings as well. Taken together, these findings led me to select the 1987 encyclopedia as it was the most comprehensive and, therefore, most reliable source.

Other Forms of Competition

One would be apt to point out that reproductive rights groups offer an ideal case study for the principles of interspecific competition outlined in the main text. I agree. Theoretically, it makes sense to directly compare the densities of two populations when the goals of those organizations are diametrically opposed. This type of diametric competition is common among a range of primarily social issues. For example, gun control, the ERA, and same-sex marriage organizations all exhibit this type of competition. Other groups that compete

[8]This section not intended for print publication.

are not diametrically opposed. Consider the interests of environmental rights groups and "big oil." While oil lobbyists often support policy that impacts the environment (initiating competition with the requisite groups), their goal is not to destroy the environment. It is, rather, to advance an economic concern. While it is beyond the scope here, future scholars should look to develop a scalar competition variable that accounts for the partial nature of competition.

Cox Proportional Hazards Model

Another potential approach to the study of two species' effect on one another is a "hazard model." A Cox Proportional Hazards Model can identify factors that affect the odds of survival of a particular group (Cox 1972). In this study, it would estimate how the founding of anti-abortion groups affects abortion-rights groups' survival and vice-versa. However, because this paper is not examining survival rates, instead looking exclusively at founding rates, a hazard model is theoretically incompatible with the data. Therefore, I do not employ one here. If i were to investigate the topic of group death further in the tradition of Nownes and Lipinski (2005), it would make sense to use a hazard model.

Growth Curves

Upon initial data collection I wanted to examine the rate of growth of these organizations. This necessitated fitting a curvilinear function to the data. Calculating this not only revealed the growth rate (r) but also the carrying capacity. I used a non-linear least-squares Levenberg Marquadt algorithm to define these population characteristics. This method was originally developed to study the exponential growth of microorganisms for analysis in R statistical software by Sprouffske and Wagner (2016). The resulting graphs for anti-abortion and abortion-rights groups are displayed in Figures 4 and 5. Ultimately, my theoretical and empirical approach made this unnecessary to include in the main body of this paper.

Figure 4

Figure 5

These figures, and the associated growth curves, are no substantively different than the data displayed in Figure 1 despite their higher level of detail.

Serial Autocorrelation

When dealing with count data of organizations, a common question raised is that of serial autocorrelation. The cumulative number of groups at $t = 0$ represents density, but the number of group formations at $t = 0$ will be correlated with formations at $t-1$. The number of groups formed last year – not just the number of groups that have accumulated since the beginning of time – will bias standard errors down. A straightforward remedy for this is to fit a Poisson autoregressive model or PAR(p). This method was developed by Brandt and Williams (2001). Because my dataset is small (n=66), I had to drop the squared covariates from analysis. Nevertheless, the results remain substantively similar to those reported in the paper.

Zero-Inflation

The abortion-rights data has few zero-observations so zero-inflated bias is not a concern. Because the anti-abortion data does not see growth until later in time (1967), there are a significant number of zero-occurrences at the beginning of the data. However, because these zeroes are not randomly distributed across the data, fitting a zero-inflated model would not be appropriate. In theory I could designate a start year of 1800 and have 167 leading zeros. To check for bias in the model, I fit models dropping the leading zero observations. The results are displayed in Table 2 below. While the few observations in this model specification do not allow for additional variables to be included, the substantive conclusions remain unchanged.

Other Theoretical Considerations

My research interest in this topic was piqued by the study of interspecific competition by Lotka (1925) and Volterra (1926). Their research was a breakthrough in the mathemetical specification of species' competition for food. Later research would consider not only competition between Species 1 for resources (e.g., lions vs. other lions) but also the competition between Species 1 and 2 (e.g., lions vs. hyenas). The latter case is "interspecific" competition and is expressed through what is now known as Lotka-Volterra equations. They take the form:

$$\frac{dx_1}{dt} = r_1 x_1 (1 - (\frac{x_1 + \alpha_{12} x_2}{K1})) \text{ and } \frac{dx_2}{dt} = r_2 x_2 (1 - (\frac{x_2 + \alpha_{21} x_1}{K2}))$$

The notation r represents the rate of growth, x is the population size (density), and K is the carrying capacity. α is the effect of one species on another with the subscripts of 1 and 2 representing the two species, respectively.

A direct application of these models did not make it into the final paper as it is more appropriate when you can operationalize a specific resource like membership numbers. Instead, I used density dependence which does not require resource specification.

Table 2

	DV: Anti-Abortion Group Formation	
	(1)	(2)
Anti-Abortion	0.356	
	(0.231)	
Anti-Abortion Sq.	-0.007^{**}	
	(0.004)	
Abortion Rights		0.844^{**}
		(0.420)
Abortion Rights Sq.		-0.008^{**}
		(0.003)
Abortion Ratio	−0.007	−0.00001
	(0.008)	(0.004)
Observations	19	19
Log Likelihood	−29.701	−29.526
Akaike Inf. Crit.	67.403	67.051

Note: *p<0.1; **p<0.05; ***p<0.01
Negative binomial regression with SEs in parentheses.