

Simmer Down Now! A Study of Revenue Volatility and Dissolution in Nonprofit Organizations

Nonprofit and Voluntary Sector Quarterly

1–21

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DOI: 10.1177/08997640221126147

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Abstract

Many nonprofit organizations operate under immense financial pressure. Revenue volatility is a common target for managers to minimize under the assumption that maintaining consistent revenue enhances the viability of the organization while high revenue volatility may disrupt planning. However, the relationship between revenue volatility and the viability of nonprofit organizations is poorly understood. This article presents the first empirical test of the link between volatility and dissolution in U.S. public charities from 2010 to 2018 ($N = 2,126,894$) using discrete time survival models. The results show that a 10% increase in revenue volatility predicts an increase in dissolution risk between 7% and 14%. In addition, the effect of revenue volatility varies by the age of the organization, suggesting volatility may be a greater threat to older organizations than to those newly formed. Implications for managers and future research are discussed.

Keywords

revenue volatility, risk, dissolution, nonprofit finance, survival analysis

Introduction

Many nonprofit organizations are subject to considerable financial stress as they rely on multiple sources of revenue and must respond to changes in donor preferences and policy trends that affect funding opportunities (Carroll & Stater, 2009; Hager, 2001;

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Tuckman & Chang, 1991). Withstanding, avoiding, and mitigating financial stress while sustaining and expanding services is a core interest for nonprofit managers (Young, 2007), and supporting nonprofit organizations is of interest to those outside nonprofit management. Public officials have imbued nonprofits with policymaking power through bureaucratic discretion and commonly collaborate with nonprofits in service delivery (Brodtkin, 2007). As a result, the ramifications of nonprofit dissolution may reach beyond organizational members and have negative consequences for the civic capacity and service networks of regions where they occur. Consequently, it is crucial to understand why organizations may decline and cease operations.

The unique fiscal environment in which nonprofits exist has led to a rich research tradition focused on the relationships between revenue flows, financial capacity, vulnerability, and risk (Hung & Hager, 2019; Jegers, 1997; Lu et al., 2019). In this tradition, scholars have long supposed that stable revenue enhances the viability and sustainability of nonprofit organizations (Carroll & Stater, 2009; Kingma, 1993). Studies of variation in revenue, called revenue volatility, have typically been interested in strategies to reduce volatility (Carroll & Stater, 2009; Mayer et al., 2012; Qu, 2020; Wicker et al., 2015) under the assumption that stable revenue may allow more accurate planning and enhanced viability. Although this literature has illuminated strategies to mitigate volatility, it has left the material impacts of revenue volatility unstudied.

Does revenue volatility increase the likelihood of dissolution? Do organizational age and revenue diversification moderate this relationship? This article provides the first empirical test of these questions in a sample of public charities in the United States. The article proceeds first by reviewing the literature related to revenue volatility and its antecedents and then tests three hypotheses related to the relationship between volatility and dissolution using form-990 data from 2010 to 2018 from the National Center for Charitable Statistics (NCCS) in discrete time survival models. The results show that revenue volatility is positively related to dissolution, while the marginal effect of revenue volatility on the likelihood of dissolution is greater for older organizations.

Literature Review

Freeman et al. (1983) employ the term dissolution to describe an organization that has “cease[d] to carry out the routine actions that sustain its structure, maintain flows of resources, and retain the allegiance of its members” (p. 694), a definition also used by Lu et al. (2020) and Park et al. (2022). Dissolution is the logical extreme of organizational decline and may result from a weak financial position or insufficient planning, which limit the ability of managers to support their organizations (Fernandez, 2008; Hager, 2001; Lu et al., 2020). Studies related to revenue volatility and dissolution currently occupy distinct areas of the nonprofit literature, however, and are important indicators of financial health (Chang et al., 2018; Greenlee & Tuckman, 2007; Hung & Hager, 2019). Current research suggests they share many of the same determinants including organizational age, size, revenue diversification, and spending patterns

(Bielefeld, 1994; Carroll & Stater, 2009; Hager, 2001; Lu et al., 2019, 2020; Mayer et al., 2012; Park et al., 2022; Wicker et al., 2015). This section reviews the literature related to revenue volatility and specifies three key hypotheses to be tested in this study.

Research on Revenue Volatility

Revenue volatility is a construct of interest in finance and economics which is commonly defined as the variance in revenue per unit (Hull, 2018), such as a year. Although the empirical literature-related revenue volatility in nonprofits is small (Lu et al., 2019), revenue volatility has been of increasing interest among nonprofit scholars for its planning and management implications. Building a broader tradition of financial risk, Kingma (1993) was the first to consider variance in revenue by applying modern portfolio theory to the financial management of nonprofit organizations. In this framework, the core management problem is the selection of revenue sources that minimize variance while maximizing returns (Markowitz, 1952). Although nonprofits may be limited in their ability to manipulate sources of revenue (Jegers, 1997), this framework has generated interest in the optimization in revenue portfolios as well as reduction in variance (Grasse et al., 2016; Qu, 2019).

Revenue volatility has been of particular interest, as researchers have investigated strategies to mitigate variation in revenue. Carroll and Stater (2009) were the first to explicitly study revenue volatility in nonprofits, suggesting that revenue diversification can reduce volatility. Mayer et al. (2012) extend this work by considering the full revenue portfolio, including overall measures of volatility and the shares of each revenue type. Similarly, Qu (2020) finds that revenue from sources outside program services and contributions may be the most volatile. Using rich financial data Wicker et al. (2015) show German sports clubs experience systemic volatility which diversification is less effective at reducing. Studying the related quantity of portfolio risk, Qu (2019) shows the relationship between diversification and risk may depend on the nonprofit's subsector.

The importance of revenue volatility. Nonprofit dissolution research shows that broadly, organizations increase their survival chances by mitigating financial vulnerability and maintaining a strong financial position (Lu et al., 2020; Park et al., 2022). Although some research has suggested financial crisis may increase chances of dissolution (Fernandez, 2008), little is currently known about the organizational-level ramifications of revenue volatility. Modern portfolio begins by assuming actors wish to minimize variance (Markowitz, 1952), and Kingma (1993) theorized about the implications of revenue volatility, suggesting that unpredictable revenue presents two problems for nonprofit managers: (a) managers invest resources with an expected return, consequently unpredictability may lead to an over investment of resources such as time, money, and energy, and (b) managers must adjust the organization's spending patterns when realized revenue differs from expectations, which can be challenging or impossible. Importantly, Kingma's theory establishes a connection between risk and the

broader literature related to financial vulnerability. Tuckman and Chang (1991) define an organization to be financially vulnerable to the extent that “it is likely to cut back its service offerings immediately when it experiences a financial shock” (p. 445), and high variance in revenue may raise the possibility of a financial shock leading to financial vulnerability (Carroll & Stater, 2009). Understanding the link between volatility and vulnerability is important as financially vulnerable nonprofits have increased chances of dissolution, insolvency, and declines in revenue (Hager, 2001; Keating et al., 2005).

Kingma’s (1993) discussion suggests high revenue volatility makes financial management more challenging, raising the possibility of vulnerability, decline, and dissolution. Yet, all existing studies of variation in nonprofit revenue are focused on the revenue mix or reward optimization (Carroll & Stater, 2009; Grasse et al., 2016; Mayer et al., 2012; Qu, 2019, 2020; Wicker et al., 2015), and the focus on revenue volatility is justified by its risks. Carroll and Stater (2009) suggest “stability may also lead to an increased ability for managers to accurately predict financial margins and consequently engage in more exact planning” (p. 963). Mayer et al. (2012) claim “Maintaining revenue stability is essential for an organization to remain financially viable” (p. 374), while Wicker et al. (2015) argue “A lower degree of revenue volatility allows clubs to better plan for the future” (p. 5). In the for-profit sector, there are well-known cases of high-risk decisions leading to negative outcomes, including closure, described in Hull (2018); however, no studies of the relationship between variation in revenue and dissolution exist, leaving a key assumption unexamined. This literature suggests that all else equal, high volatility disrupts planning and managerial goals, contributing to organizational decline and ultimately resulting in dissolution, leading to Hypothesis 1.

Hypothesis 1: Nonprofits with higher revenue volatility are more likely to dissolve.

Sources of Revenue and Diversification

The connection between financial vulnerability and volatility makes revenue diversification an important consideration, and several studies suggest that revenue diversification can mitigate revenue volatility (Carroll & Stater, 2009; Mayer et al., 2012; Wicker et al., 2015). Ideally, diversification facilitates stability in revenue, as a negative shock to one source of revenue is reduced by the organization’s ability to draw from a different source and replace losses (Carroll & Stater, 2009; Chang & Tuckman, 1994). Revenue diversification can also permit greater growth potential and viability by exposing nonprofits to a larger group of funders and community members capable of providing financial opportunities (Hung & Hager, 2019). This has made revenue diversification a key variable in prior research on dissolution, which has shown nonprofits with more diversified revenue are often more viable (Hager, 2001; Lu et al., 2020).

The importance of diversification is limited by other organizational features that may reduce a nonprofit’s ability to exchange revenue sources to offset losses and maintain stability (Jegers, 1997). The sources of revenue are also important, often yielding distinct benefits. Revenue from program services is widely believed to be

more flexible and less volatile than other sources, and large shares of revenue from program services may indicate self-sufficiency (Froelich, 1999). Mayer et al. (2012) find volatility is minimized with larger shares of revenue from programs, and Lu et al. (2020) show organizations that receive a majority of revenue from programs have lower risk of dissolution. Yet, revenue from programs is often associated with commercialization, which can lead to mission drift (Jones, 2007). Large shares of contributed revenue may indicate community connections, something that greatly supports the viability of the organization by enhancing embeddedness (Fernandez, 2008; Hager et al., 2004). However, contributions are subject to competition in the nonprofit sector and may be particularly volatile (Mayer et al., 2012; Thornton, 2006). For example, Carroll and Stater (2009) find donative organizations experience higher revenue volatility than others. The primary remaining sources of revenue for nonprofits are government grants and investments. Froelich (1999) suggests government grants may have the lowest volatility, often providing stable revenue for extended periods. However, government grants may increase administrative burden and crowd out private contributions (Andreoni & Payne, 2003). Sources outside of program services, contributions, and government grants, such as revenue from investments, may be the most volatile (Mayer et al., 2012; Qu, 2020).

Current research on revenue diversification suggests nonprofits benefit in several ways from maintaining diversified revenue portfolios. Each source of revenue can bring unique benefits, and nonprofits benefit from having access to a greater number of sources to offset losses, promote flexibility, and grant access to community members (Hung & Hager, 2019). This suggests that revenue diversification may decrease the likelihood of dissolution, as well as change its relationship with revenue volatility. The negative effects of a shock to revenue may be mitigated in nonprofits with a diversified revenue portfolio, as diversification may allow nonprofits to replace or supplement losses with another source (Carroll & Stater, 2009; Tuckman & Chang, 1991), leading to Hypotheses 2a and 2b.

Hypothesis 2a: Revenue diversification moderates the relationship between revenue volatility and dissolution.

Hypothesis 2b: The marginal effect of revenue volatility on dissolution is lower when revenue is more diversified.

Organizational Age

Organizational ecologists have long suggested the importance of age in determining the survival of organizations, positing that young organizations are at high risk of dissolution (Amburgey, 1996). The age dependence hypothesis is well supported among nonprofits as studies over a range of time periods have consistently shown younger nonprofits are more likely to dissolve (Bielefeld, 1994; Hager et al., 2004; Lu et al., 2020; Park et al., 2022) and have less diversified revenue portfolios (Fischer et al., 2011). Explanations for the importance of age often center around legitimacy, which broadly describes the fit between an organization's activities and their environment

(Dowling & Pfeffer, 1975). With respect to age, ecologists emphasize the time it takes for organizations to develop the connections and legitimacy required to make claims on resources (Freeman et al., 1983). As differences in age may imply different access to resources, organizations at different ages may have different abilities to leverage connections and reputation to handle financial shocks. This leads to Hypothesis 3a.

Hypothesis 3a: Organizational age moderates the relationship between revenue volatility and dissolution.

Younger organizations often have a less well-defined niche, and have yet to solidify organizational routines, making them particularly vulnerable (Yang & Aldrich, 2017). Hager et al. (2004) suggest the relationship between age and survival in nonprofits is attributable to the development of network ties, and embeddedness becomes less vital to organizations as they mature. As organizations age and build networks, they may gain access to information and expertise which can grant access to a variety of financial expertise or products, including investment (Porter & Powell, 2006; Wiewel & Hunter, 1985). Although they may have less access, young nonprofits also benefit from riskier strategies in an effort to grow and achieve viability more quickly, such as specialization or revenue concentration, accepting increased variation in revenue in an effort to establish themselves and strengthen their position in markets (Chikoto-Schultz & Neely, 2014; James, 1983; Ramey & Ramey, 1995).

This literature shows that resource access may vary with legitimacy and embeddedness, explaining age-dependent survival rates in nonprofit organizations. Hypothesis 3a states that the relationship between revenue volatility and dissolution is moderated by organizational age; however, younger nonprofits may be better suited to experience high variation in revenue: benefiting from growth which mitigates competition and enhances viability, leading to Hypothesis 3b.

Hypothesis 3b: The marginal effect of revenue volatility on dissolution is higher for older nonprofits.

Methods and Materials

The contribution of this study is to investigate the relationship between dissolution and volatility among nonprofit organizations. The hypotheses are tested with a panel constructed of nonprofits from 2010 to 2018. Data are drawn from the NCCS Core Files and the Internal Revenue Service's automatic revocation file. In the United States, nonprofits that generate an average of 50,000 dollars in gross receipts are required, annually, to file tax documents ("Return of Organization Exempt from Income Tax," typically some variety of form-990). The basic financial information reported on these documents is captured in the NCCS Core Files, which are the primary data source for this study. Following a change in 2006, an organization's nonprofit status was revoked if it failed to file tax documents for three consecutive years, with the first set of revocations occurring in 2010. In the files from 2010 to 2018, all forms were filed after the

process was enacted to ensure organizations in the sample were subject to the automatic revocation process. Beginning in 2010 also avoids the revocation of nonprofits that may have dissolved long before, only to be noticed by the IRS in 2010. The automatic revocation list provides the names and employer identification numbers (EIN) of all organizations for which this occurred, as well as the date of the revocation.

The Core Files from 2010 to 2018 contain 3,673,314 observations of 591,453 organizations. Observations were excluded if they contained erroneous values, including negative revenue, assets, or expenses (in any category), or a category (and the sum) of revenue or expenses greater than is reported in the “total” categories. Observations were also removed that were missing information such as rule date, location, or beginning of year assets (Feng et al., 2014; Shon et al., 2019). Organizations not listed as operating public charities are also excluded, as other organizations, such as private foundations and supporting organizations are often distinct with respect to financial management and goals. Finally, as explained below, the measure of volatility used in this study requires a minimum of two observations, and organizations with fewer than two observations were removed. The final sample contains 2,126,894 observations of 378,163 organizations.¹ All financial variables were inflation adjusted to represent 2020 dollars.

Dependent Variable: Nonprofit Dissolution

The dependent variable in this study is nonprofit dissolution, defined by Freeman et al. (1983), as an organization that has ceased to carry out its mission. Dissolved organizations are identified using the IRS automatic revocation list and the core files (Lu et al., 2020; Park et al., 2022). Although the automatic revocation list contains all organizations that lost nonprofit status through the automatic revocation process, they may later reapply and re-obtain nonprofit status, which is not a dissolution. The EIN is assigned independently of tax exemption, and an organization that re-obtains exemption retains their EIN. Accordingly, the dissolution of organizations is further validated using the Core Files. An organization is identified as dissolved and coded “1” if it has not submitted tax forms since the year its nonprofit status was revoked, while all other observations are coded “0.” This ensures that each organization can dissolve a maximum of one time.

As others using this method have noted, dissolution necessarily occurs after the organization’s last filing with the IRS. The IRS then revokes nonprofit status 2 years after the dissolution. For example, the last filing for a nonprofit that dissolved in 2015 would occur in 2014, and the IRS would revoke nonprofit status after three consecutive years without filing, resulting in a revocation in 2017. Note that a nonprofit that fails to file and does not appear in the revocation file cannot be verified as dissolved, and consistent with prior literature is coded as undissolved (Lu et al., 2020). All independent variables are lagged by 1 year, as the last available data occur 1 year prior to dissolution and to guard against endogeneity. Restricting the study to dissolutions is consistent with prior literature (this method was developed in Lu et al., 2020, and applied similarly in Park et al., 2022); however, it is important to note that organizations may enter and exit for any number of reasons, including but not limited to

preferring for-profit status, mission completion, and merger (Fernandez, 2008; Hager et al., 1996; Searing, 2020).

Key Independent Variables

Measurement of revenue volatility. The key independent variable in this study is revenue volatility, a quantity measured at each year and comprised of growth and instability (Hull, 2018). Revenue volatility has been measured in several different ways in the nonprofit literature, including the standard deviation of a nonprofit's total revenue, a weighted variance, or the variance conditional on a set of covariates (Carroll & Stater, 2009; Mayer et al., 2012; Qu, 2020; Wicker et al., 2015). However, maintaining a longitudinal perspective of volatility is important as it permits greater understanding of the mechanism (Harrell, 2015), for example, when revenue volatility is most important. In this study, revenue volatility is measured using the method found in Carroll and Stater (2009), as it provides a longitudinal measure, maintains the structure of the panel, and accounts for organizational size and sector wide growth. The measure has also been used in other studies of nonprofits and public administration (Chikoto-Schultz & Neely, 2016; White, 1983). Creating this measure is done as follows: a model for the log of total revenue is first estimated (using ordinary least squares) which includes a linear time trend and organizational fixed effects. Having estimated this model, revenue volatility is found as the absolute value of the residual divided by the prediction (which occur for each observation), which is multiplied by one hundred to represent the percent that realized revenue has diverged from predicted revenue.

Measurement of diversification and organizational age. Hypotheses 2 and 3 suggest the relationship between revenue volatility and dissolution risk varies by the diversification of the organization's revenue portfolio as well as their age. Organizational age is measured by subtracting the rule date from study year (Lu et al., 2020). The overall diversification of the organization's revenue portfolio is measured using a diversity index, which involves the familiar Herfindahl–Hirschman Index (HHI). The HHI is constructed by summing the squared shares of the organization's revenue sources, including revenue from program services (part 8, line 2G), contributions (part 8, line 1H), investments (part 8, line 3A), and other (part 8, line 11E), using four sources is largely consistent with prior research in nonprofit finance (Hung & Hager, 2019).² The result is then subtracted from one to create an overall measure of diversification. The diversification index provides an overall measure of diversification; however, as discussed above, the composition of the revenue portfolio matters as well (Mayer et al., 2012; Qu, 2019). Consequently, the percent of revenue the organization receives from program services and contributions are included.

Control Variables

Several studies have demonstrated that nonprofit dissolution and volatility share common antecedents, particularly indicators of financial vulnerability. It is important to

control for these variables to mitigate the possibility of spurious relationships. The key features include the spending patterns, the amount spent on fundraising and administration, as well as equity balances, organizational size, and particulars of the organizational niche, such as density and industry (Carroll & Stater, 2009; Chang & Tuckman, 1994; Lu et al., 2020; Mayer et al., 2012; Park et al., 2022).

Expenses and spending patterns. As Mayer et al. (2012) explain, total expenses provide a strong measure of organizational size which avoids problems with measuring size by total assets or number of staff. Although staff are an important component of organizational size, the number of staff may be difficult to capture for many organizations, and staff are not counted as assets. For this reason, the current study adopts total expenses (part 9, line 25a) as a measure of organizational size (Carroll & Stater, 2009; Mayer et al., 2012). The way nonprofits spend has implications for the way they are viewed by the public, their financial flexibility, as well as their organizational identity and expertise. Spending on administration, fundraising, and other areas outside of programs are often minimized in an effort to appear more favorable to the public and potential donors. For example, Tinkelman and Mankaney (2007) find administrative spending may crowd out donations, as donors seek more “efficient” nonprofits. Despite its drawbacks, administrative expenses provide safeguards against negative financial shocks, as managers may reduce salaries to offset losses (Keating et al., 2005; Tuckman & Chang, 1991). Hager (2001) found increases in administrative spending enhanced the survivability of nonprofits, while Lu et al. (2020) found a non-linear relationship between dissolution and spending on compensation and fundraising. Spending patterns are also correlated with the organization’s revenue mix, as donations and government grants restrict spending on administration (Shon et al., 2019). Accordingly, the percent spent on fundraising (found as the sum of part 8 lines 8B, 9B, and part 9, line 11E) and the percent it spends on officer’s compensation (part 9, line 5A) are included as control variables.

Assets. As volatility may include growth and instability (White, 1983), it is important to consider indicators of organizational growth that confound the likelihood of dissolution and revenue volatility. One such feature is net assets, which has been a strong predictor of revenue volatility in several studies (Carroll & Stater, 2009; Mayer et al., 2012). Net assets also provide an indication of financial flexibility for nonprofits and are primarily accumulated to reduce vulnerability (Calabrese, 2012). Net assets are defined as the assets held by the organization at the end of the year less the amount held at the beginning of the year (year-end, part 10, line 16B, less beginning of year assets, part 10, line 16A).

Niche density. The organizational niche is a multidimensional concept fundamental to organizational ecology, which describes where organizations fit in the larger ecosystem and defines the boundaries of competition (Hannan & Freeman, 1989), and has been an important element in prior studies of dissolution (Hager et al., 2004; Lu et al., 2020; Park et al., 2022). Nonprofits regularly encounter competitive forces, including

changes to the density in their niche (Paarlberg & Hwang, 2017; Thornton, 2006). Hager et al. (2004) found effects consistent with zero for niche density; however, more recent work has found dissolution is more likely in areas with higher density (Lu et al., 2020; Park et al., 2022). In this study, niche density is measured by the total number of organizations listed in the same county (FIPS code) with the same National Taxonomy of Exempt Entity Code (NTEE, using the “major code”—the first character), a measure similar to Thornton (2006) and consistent with the broader ecological literature (Carroll & Hannan, 2000). In addition, the industry in which the organization exists has implications for the volatility it experiences (Young, 2007) and may affect the likelihood of dissolution (Lu et al., 2020; Park et al., 2022); accordingly, the organization’s “major group” (a higher level classification of NTEE codes) is controlled for, including the categories of health, human services, arts, education, and “other.”

Empirical Strategy

As scholars have long noted (Freeman et al., 1983; Hager et al., 2004; Lu et al., 2020; Park et al., 2022) survival and dissolution rates are (right) censored, as more organizations will certainly dissolve in the future. This makes survival analysis (also known as, among others, event history or duration analysis) a natural choice for addressing the research questions and provides valuable information about the underlying mechanism (Harrell, 2015). However, typical survival models are developed for continuous time, while the data in this study are observed in discrete time, observed annually. Accounting for the unique time structure is important, unlike continuous time survival models the event occurs in an interval between observations. The discrete time hazard function can be written as $\lambda(t | x) = P(T = t | T \geq t, x)$, where λ is the hazard function, x is the class of covariates, T is the random variable governing the events which occurs in intervals of time t , with corresponding discrete survival function $S(t | x) = P(T > t | x)$. Then, the parametric hazard can be written $\lambda(t | x) = h(\gamma_{0t} + X\beta)$, where h is a monotonically increasing (distribution) function. This also emphasizes that the constant, γ_{0t} , depends on time (Tutz & Schmid, 2016). When time is grouped, the proportional hazards model is commonly called the “grouped proportional hazards” model, which results in a Gompertz distribution for h , and can be written as $\lambda(t | X) = 1 - \exp(-\exp(\gamma_{0t} + X\beta))$ where $X\beta$ are a matrix of variables and vector of parameters which can be estimated by maximum likelihood. This model results from the Cox proportional hazards model when time is grouped (Tutz & Schmid, 2016), and parameters are interpreted similarly to the continuous time proportional hazards model, exponentiated to the hazard ratio.

Using this model, Hypothesis 1 is tested by entering revenue volatility as a time-varying covariate. Hypotheses 2 and 3 are tested by adding interactions between revenue volatility and the organization’s age as well as the measure of revenue diversification. The interactions address the hypotheses by allowing variation in the relationship between dissolution risk and volatility by the organization’s level of revenue diversification and age.

All empirical applications face three sources of endogeneity: reverse causality, unobserved heterogeneity, and measurement error. Reverse causality is implausible in this study as variables are lagged by 1 year establishing temporal precedence. In the discrete time survival, framework described above unobserved heterogeneity is accommodated with cluster-robust inference for β , clustering at the organization to allow correlated observations within organizations and obtaining heteroscedastic consistent estimates of variance³ (Zeileis, 2006). Although measurement error is possible, the study follows the extant literature in measuring key variables such as dissolution and volatility, while also entertaining a range of alternative specifications.⁴

Results

Descriptive statistics for the study variables are shown in Table 1; organizations in the sample are roughly 21 years old on average and maintain a relatively diversified revenue portfolio drawn primarily from contributions and program services. The average volatility is 2.52%, very close to the average volatility found in Carroll and Stater (2009) which found average volatility of the sector to be 2.49 ($SD = 4.45$). The average organization in the sample spends little on fundraising and administration, while total expenses and net assets show great variation as the sample includes nonprofits of all sizes. Using the revocation file and core files to identify dissolutions results in 3,599 dissolved organizations, just under 1% of the organizations in the sample,⁵ while dissolution is censored for the remaining 99%. The zero-order correlation between revenue volatility and the other key variables is low, $-.07$ with revenue diversification and $-.03$ with organizational age.

Convergence was unproblematic for all models. The highest variance inflation factor found was in Model 2 for the percent of revenue from contributions, and is 5.3, while the variance inflation factor for all key variables are below 1.1, showing little evidence of multicollinearity. The results of the first model are shown in Table 2, which show the estimates and confidence intervals constructed using cluster-robust inference. Following prior studies that employ survival analysis (Lu et al., 2020; Park et al., 2022), the results display the estimates on the scale of the link function (complementary log-log) as well as hazard ratios. In contrast to the estimates on the link scale, the hazard ratio indicates a positive relationship when it is above 1, and a negative relationship when it is below 1. Note that the variables have also been scaled to yield sensible interpretations.

The interactions corresponding to Hypotheses 2a and 2b and 3a and 3b are added in the second model; the full results of which are shown in Table 3. The second model is preferred showing improvements in Akaike information criterion (AIC, 9.2) and Bayesian information criterion (BIC, 19.2). Across models, revenue volatility is a significant predictor, positively related to dissolution. The results show that an increase of 10% in revenue volatility predicts an increase in the risk of dissolution between 7% and 14%. Table 3 shows that the interaction between age and revenue volatility is statistically significant, while the estimate for the interaction between revenue diversification and revenue volatility is consistent with zero. Table 3 confirms organizational

Table 1. Descriptive Statistics for Final Sample ($N = 2,126,894$).

Variable	Definition	M	SD	Min	Max
Revenue volatility	Calculated according to Carroll & Stater (2009)	2.52	5.63	0.00	510.98
Age	Year – Rule date	21.32	17.18	0.00	118.00
Revenue diversification ^a	I-HHI	0.56	0.42	0.00	1.00
Contributions (%)	Contributed revenue/total revenue	52.49	40.18	0.00	1.00
Program services (%)	Program service revenue/total revenue	36.84	39.69	0.00	1.00
Investments (%)	Investment income/total revenue	1.83	9.06	0.00	1.00
Net assets ^b	End of year assets – beginning of year assets	51.13	2,420.74	-566,133.30	1,373,865.61
Total expenses ^b	Sum of expenses	653.64	13,343.53	0.00	5,676,767.21
Administrative (%)	Officer compensation/total expenses	4.31	9.49	0.00	1.00
Fundraising (%)	Fundraising expenses/total expenses	0.11	1.91	0.00	1.00
Niche density	Number of organizations in county and NTEE	141.91	284.09	1.00	2,348.00
Industry		COUNT	Percent		
Human services		822,113	38.64		
Health		263,107	12.36		
Education		300,961	14.15		
Arts		242,655	11.41		
Other		498,058	23.42		
Dissolution ^c	IRS definition using auto revocation	3,599	0.17		

Note. All financial variables are measured in 2020 dollars. Data from NCCS core files, 2010–2018. SD = standard deviation; HHI = Herfindahl–Hirschman Index; NTEE = National Taxonomy of Exempt Entity Code; NCCS = National Center for Charitable Statistics; IRS = Internal Revenue Service.

^aIncludes contributions, program services, investments, and other.

^bScaled to units of 10,000 dollars.

^cUsing the IRS definition, 3,599 organizations out of 378,163 were identified as dissolved (0.95%).

Table 2. Discrete Time Survival Results, Revenue Volatility, and Dissolution (*N* = 2,126,894).

Variable	Estimate	CI	Hazard ratio	CI
Revenue volatility ^a	0.10***	[0.06, 0.12]	1.10***	[1.07, 1.13]
Age ^b	-0.33***	[-0.39, -0.26]	0.72***	[0.68, 0.77]
Revenue diversification	-2.63***	[-3.05, -2.21]	0.07***	[0.05, 0.11]
Contributions ^a (%)	-0.29***	[-0.34, -0.24]	0.75***	[0.72, 0.79]
Program services ^a (%)	-0.02**	[-0.04, -0.01]	0.98**	[0.96, 0.99]
Total expenses ^c	-12.65	[-27.73, 2.44]	0.00	[0.00, 11.47]
Fundraising ^a (%)	0.08	[-0.07, 0.22]	1.08	[0.93, 1.24]
Administrative ^a (%)	-0.19***	[-0.25, -0.12]	0.83***	[0.78, 0.88]
Net assets ^c	-0.07*	[-0.13, -0.01]	0.93*	[0.88, 0.99]
Niche density ^b	0.06***	[0.03, 0.10]	1.07***	[1.03, 1.10]
Arts ^d	-0.06	[-0.19, 0.07]	0.94	[0.83, 1.08]
Education ^d	-0.19**	[-0.32, -0.06]	0.82**	[0.72, 0.94]
Health ^d	0.17*	[0.04, 0.30]	1.19*	[1.04, 1.36]
Human services ^d	0.20***	[0.12, 0.29]	1.22***	[1.13, 1.33]

Note. AIC = 48,613.47. BIC = 48,814.59. CI is 95% coverage using cluster-robust standard errors, clustered at the organization. All independent variables are lagged by 1 year. AIC = Akaike information criterion; BIC = Bayesian information criterion; CI = confidence interval.

^aScaled to units of 10%.

^bMean centered and scaled to variance of one.

^cScaled to units of 10,000 dollars.

^d“Other” is the reference category.

p* < .05. *p* < .01. ****p* < .001.

age as a strong predictor of dissolution, a 1 standard deviation increase in age predicts an increase of dissolution risk between 68% and 76%. Table 3 also shows a statistically significant interaction between revenue volatility and age, suggesting a 1-unit increase in the interaction increases the organization’s risk of dissolution by 4%. A graphical interpretation of this interaction is shown in Figure 1, along with the age of dissolved organizations in the sample.

Figure 1 (panel A) shows dissolutions are clustered in young organizations, with the number of dissolutions peaking near 5 years of age, and largely decreasing with age, 50% and 75% of dissolutions occur in organizations 12 and 23 years or younger, respectively. Figure 1 (panel B) shows the heterogeneity in the effect of revenue volatility experienced by organizations at different ages. The slope is nonzero for all ages; however, it shows the predicted dissolution risk increases more quickly as a function of volatility for older nonprofits. This shows that the effect of volatility on dissolution is stronger for older nonprofits.

Although not the focus of this study, Table 3 also shows several control variables are statistically significant, including negative relationships between dissolution risk and revenue diversification, as well as the percent of revenue from contributions and program services.

Table 3. Discrete Time Survival Model Results, Including Interactions With Revenue Volatility ($N = 2,126,894$).

Variable	Estimate	CI	Hazard ratio	CI
Revenue volatility ^a	0.10***	[0.07, 0.13]	1.10***	[1.07, 1.14]
Age ^b	-0.33***	[-0.39, -0.27]	0.72***	[0.68, 0.76]
Revenue diversification	-2.64***	[-3.06, -2.21]	0.07***	[0.05, 0.11]
Contributions ^a (%)	-0.29***	[-0.34, -0.24]	0.75***	[0.71, 0.78]
Program services ^a (%)	-0.03**	[-0.04, -0.01]	0.97**	[0.96, 0.99]
Total expenses ^c	-12.53	[-27.55, 2.49]	0.00	[0.00, 12.02]
Fundraising ^a (%)	0.08	[-0.06, 0.22]	1.08	[0.94, 1.24]
Administrative ^a (%)	-0.19***	[-0.25, -0.12]	0.83***	[0.78, 0.88]
Net assets ^c	-0.07*	[-0.13, -0.01]	0.93*	[0.88, 0.99]
Niche density ^b	0.06***	[0.03, 0.10]	1.07***	[1.03, 1.10]
Arts ^d	-0.06	[-0.19, 0.08]	0.95	[0.83, 1.08]
Education ^d	-0.19**	[-0.33, -0.06]	0.82**	[0.72, 0.94]
Health ^d	0.17	[0.04, 0.30]	1.19	[1.04, 1.35]
Human services ^d	0.20***	[0.12, 0.29]	1.22***	[1.12, 1.33]
Age ^b by volatility ^b	0.04**	[0.02, 0.05]	1.04**	[1.02, 1.05]
Diversification ^b by volatility ^b	-0.01	[-0.02, 0.01]	0.99	[0.98, 1.01]

Note. AIC = 48,604.25. BIC = 48,795.39. CI is 95% coverage using cluster-robust standard errors, clustered at the organization. All independent variables are lagged by 1 year. AIC = Akaike information criterion; BIC = Bayesian information criterion; CI = confidence interval.

^aScaled to units of 10%.

^bMean centered and scaled to variance of one.

^cScaled to units of 10,000 dollars.

^d“Other” is the reference category.

* $p < .05$. ** $p < .01$. *** $p < .001$.

The magnitude of the effects estimated for contributed revenue are larger than that of revenue from program services, implying that revenue portfolios constructed of a larger share of contributions correspond to lower risk of dissolution. Other significant predictors include a wide interval estimate for administrative spending; a 10% increase in the share of expenses on officers predicts a decrease in dissolution risk between 22% and 12%. A 10,000 dollar increase in net assets corresponds to a decrease in risk of dissolution between 12% and 1%, and an increase of 1 standard deviation in non-profit density predicts an increase in risk of dissolution between 3% and 10%. Table 3 also shows education organizations have a lower risk of dissolution than those in the “other” category, while human service organizations have higher risk.

Discussion

Research on dissolution is required to provide managers and policymakers with knowledge about the benefits and risks inherent in management strategies. Prior research and theory have suggested that revenue volatility may inhibit the planning

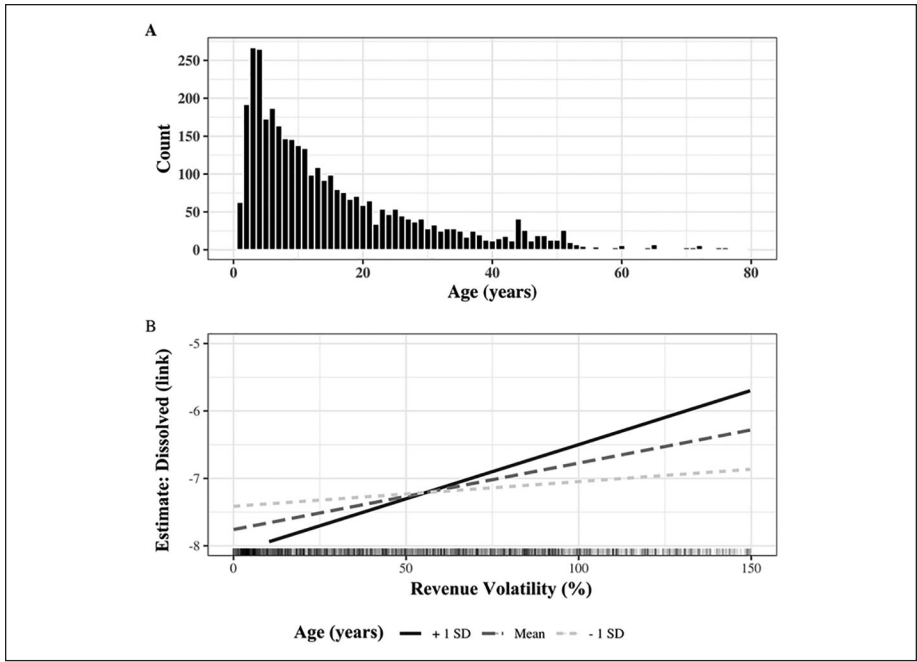


Figure 1. Organizational age at dissolution (A) and the interaction of revenue volatility with ruling year on the likelihood of dissolution (B).
Note. Panel A shows a histogram (with bin width of one) of the ages at which organizations dissolved in the sample. Panel B shows the interaction of volatility and age found in the model shown in Table 3, using the observed revenue volatility of organizations in the sample (shown at the bottom of the figure) from 0% to 150%. One standard deviation of age is approximately 17 years. In panel B, the estimate is shown on the link scale (complementary log-log).

ability of nonprofit managers, resulting in an inefficient allocation of resources leading to organizational decline (Kingma, 1993). However, no studies exist in the nonprofit literature linking measures of revenue volatility to nonprofit dissolution. To address this gap, this article has used archival data to provide an empirical test. The study has also explored possible mediators, age and revenue diversification, as nonprofits may experience risk differently at various stages of the life cycle, and diversified revenue may allow nonprofits to mitigate the deleterious effects of shocks to revenue by granting access to alternative revenue sources. Hypothesis 1 posits a positive relationship between risk of dissolution and revenue volatility, which the results strongly support. This finding may enable nonprofit managers to weigh the risks and rewards of a financial strategy more accurately and suggests that all else equal, nonprofit managers may wish to promote strategies that enhance financial stability.

Prior research has identified revenue diversification as an important predictor of dissolution risk, and scholars have often held that one benefit of diversification is the ability to offset losses through enhanced financial flexibility (Carroll & Stater, 2009;

Tuckman & Chang, 1991). Accordingly, Hypothesis 2a states that the relationship between dissolution risk and volatility is moderated by the organization's revenue diversification, which was not supported by the results. Furthermore, Hypothesis 2b suggests that the marginal effect of revenue volatility on dissolution is lower in nonprofits with more diversified revenue, which was also not supported. Although the data in this study provide no evidence that diversification moderates the relationship between dissolution and revenue volatility, the results provide further support for the protective effects of revenue diversification, emphasizing the auxiliary benefits of diversification (Hager et al., 2004; Hung & Hager, 2019) as the effect of diversification in this study cannot be explained by reduced revenue volatility.

Consistent with prior research, this study shows age is a strong predictor of dissolution risk (Hager et al., 2004; Lu et al., 2020; Park et al., 2022). The age of an organization is often an indicator of resource access and legitimacy (Hager et al., 2004; Wiewel & Hunter, 1985), and younger organizations may benefit from taking riskier positions to grow quickly and solidify their position in competitive markets. Consequently, Hypothesis 3a states that the relationship between dissolution risk and volatility is moderated by organizational age. The results supported this hypothesis finding a statistically significant interaction between organizational age and revenue volatility in Model 2. Furthermore, Hypothesis 3b suggests the marginal effect of volatility on dissolution is higher among older nonprofits, which was also supported by the results. Although a comparatively small estimate, this heterogeneity may be explained by the positive relationship between volatility and growth (Ramey & Ramey, 1995). Young nonprofits may seek to grow rapidly in ways that are difficult to predict, accepting this risk as it brings them into viability more quickly. This suggests that young nonprofits may experience fewer negative effects from engaging in riskier financial strategies, such as specialization or revenue concentration (Chikoto-Schultz & Neely, 2014), while the marginal effect of revenue volatility on dissolution increases with age.

Interestingly, the results from this study show total expenses, the measure of organizational size, is not a significant predictor of dissolution risk. One possibility is that size matters less once indicators of financial vulnerability are considered, particularly revenue volatility. In addition, in contrast to Lu et al. (2020), the results in this study find a negative, linear estimate, for administrative spending. This supports the theory that administrative spending provides flexibility for managers, providing an area to cut expenses and create slack during crisis (Keating et al., 2005; Tuckman & Chang, 1991). In contrast, the results of this study do not find fundraising expenses to be a significant predictor of dissolution. One possibility is that fundraising expenses are used differently across organizations; some may cut back during a financial downturn while others seek to improve their financial position through fundraising, increasing variance when averaged over the population.

While this study shows volatility presents a clear risk to nonprofits, it has focused on volatility in 1 year prior to dissolution. It is possible that these nonprofits have consistently experienced negative income shocks leading to their eventual dissolution. Future research may investigate the cumulative effects of volatility on the viability of

nonprofits. Reducing volatility through revenue strategies is not straightforward, as nonprofit managers are often restricted in their ability to alter revenue and capital structures (Jegers, 1997). For this reason, understanding heterogeneity is crucial to allow managers to understand when volatility is most threatening. This study hypothesized two factors that may moderate the negative impacts of volatility; however, future research may seek to investigate additional protective factors. Future research may also consider a broader class of organizational exits (Hager et al., 1996; Searing, 2020), as volatility may behave differently by exit type, as well as additional measures of revenue volatility. Fundamentally, more research is needed on dissolution and volatility.

There are several limitations to this study worth emphasizing. It is widely known that the form-990 was not designed for research purposes, conflating important revenue categories as well as organizations and establishments. It is important in this study as the data render the analysis unable to control for government funding, which may be the least volatile source of revenue for nonprofits (Froelich, 1999). Furthermore, the method used to identify dissolutions in this study is strict and may not capture all organizations that have ceased operations (Lu et al., 2020; Park et al., 2022). Although this is important to identify homogeneous exit types, additional research is needed on identifying dissolution in archival records. Although survival analysis has been the choice method for quantitative studies of organizational dissolution and demise, it is not well suited for causal inference in the observational setting (Hager et al., 2004; Lu et al., 2020; Park et al., 2022). Finally, this article has used one measure of revenue volatility, and future research may benefit from employing alternative measures (e.g., Mayer et al., 2012).

Conclusion

This article has presented the first empirical test of dissolution and volatility. Using discrete time survival models. The results show evidence that revenue volatility does reduce the survival chances of nonprofits. This supports the claims made in the volatility literature, which has long suggested nonprofits benefit from stable revenue. Reducing volatility becomes more important for survival as organizations age, as younger organizations may benefit from quickly moving into a competitive position. However, more research is needed on the organization-level implications of volatility to inform managers about the risks of financial strategies.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. Beginning with 3,673,314 observations, 532,993 were removed because the organizational form did not fit the inclusion criteria (e.g., out of scope, private foundation, or supporting organization). An additional 1,013,427 observations were removed for missing or erroneous values in key variables or for pertaining to an organization that filed once over the study period (for which volatility could not be calculated). This is not uncommon in the use of archival tax data, Lu et al. (2020) begin with 4,068,459 observations, and proceed with a final sample of 1,407,017, and Park et al. (2022) begin with 3,806,705 observations, resulting in a final sample of 1,723,475.
2. Hung and Hager (2019) find most studies use a diversity index constructed from three sources; however, their results suggest the effect size depends in part on the number of sources. The measure in this study is found following this equation: $1 - \sum_i \left(\frac{s_i}{t} \right)^2$ where i indexes revenue source s and t is total revenue. Some studies multiply the result by a constant (see, for example, Carroll & Stater, 2009; Fischer et al., 2011), while others do not (Qu, 2019); however, this does not change the interpretation.
3. This study uses the “HC1” robust standard error which adjusts for degrees of freedom; this is arguably the most common found in the literature (it is the default in Stata’s “robust” function).
4. Several sensitivity analyses were also entertained, the results of which can be found in the online appendix. A rare events logistic regression produced results qualitatively similar to those presented in the main analysis, and discrete time survival models on the data winzorized at 5th and 95th percentiles found an estimate for revenue volatility of 0.35 (confidence interval [CI]: [0.19, 0.50]), with a statistically significant interaction between volatility and age. When the revenue portfolio and age are omitted, the estimate for revenue volatility rose to 0.16 (CI: [0.14, 0.18]). The findings are also unlikely due to sampling bias; the method described in Frank et al. (2013) shows 60.8% of the estimate would have to be due to bias to invalidate the estimate, or 1,293,166 observations would have to be replaced with cases for which the relationship is zero.
5. Similarly low rates of dissolution are found in Lu et al. (2020) and Park et al. (2022). These studies report the mean of dissolution, .007 and .001, respectively.

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