

Survival and the Ergodicity of Corporate Profitability

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Received: October 8, 2020

Revised: November 10, 2021

Accepted: December 3, 2021

Published Online in Articles in Advance:
March 25, 2022

<https://doi.org/10.1287/mnsc.2022.4395>

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Abstract. The cross-sectional variation in corporate profitability has occupied research across fields as diverse as strategic management, industrial organization, finance, and accounting. Prior work suggests that corporate idiosyncrasies are important determinants of profitability, but it disagrees on the quantitative importance of particular effects. This paper shows that corporate specificities become irrelevant in the long run because profitability is ergodic conditional on survival, leading to a uniform, time-invariant regularity in profitability that applies across firms. Conditional on survival, we cannot reject the hypothesis that corporations are on average equally profitable and also experience equally volatile fluctuations in their profitability, irrespective of their individual characteristics. Because the same is not true for shorter-lived firms, even for more than 20 years after entry, we can reconcile our findings with an extensive literature that studies profitability in heterogeneous samples of surviving and shorter-lived firms. Our findings provide a new benchmark for long-term performance in competitive environments and offer a novel perspective by highlighting a robust commonality instead of specificities.

History: Accepted by Alfonso Gambardella, business strategy.



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Funding: This work was supported by the Generalitat Valenciana [Grant AICO-2021-005] and University Jaume I [Grant UJI-B2018-77].

Supplemental Material: Data and the online appendix are available at <https://doi.org/10.1287/mnsc.2022.4395>.

Keywords: performance • dynamic competition • corporate strategy • stochastic differential equation

1. Introduction

We revisit the long-standing debate on how corporate idiosyncrasies affect profitability, finding that idiosyncrasies correlate with profitability for shorter-lived firms but surprisingly have no impact on surviving firms, whose profitability is ergodic. Here ergodicity refers to the notion that we cannot statistically distinguish the moments of the cross-sectional distribution of survivors’ return on assets (ROA) from the moments of their individual ROA time series. Not only do survivors exhibit the same profitability on average, they also experience equally volatile fluctuations in their profitability. Our findings thus depart from an extensive literature across fields as diverse as strategic management, industrial organization, finance, and accounting that investigates the dynamics and cross-sectional properties of corporate profitability. The literature observes that various idiosyncrasies have a systematic influence on profitability and imply persistent cross-sectional variation in corporate ROA, in particular year, industry, business-unit, and corporate-parent effects. We argue here that the

influence of such effects disappears after about two and a half decades of survival, revealing an almost universal regularity that is invariant over time and across firms.

Because the perpetual flux of companies into and out of the market obscures this regularity in corporate profitability, our empirical analysis emphasizes the destinies of surviving corporations to uncover it. In spite of the fact that few corporations survive the proverbial gales of creative destruction for more than a couple of decades (Fama and French 2004), creative destruction apparently occurs more in name than in substance because transfers of ownership are responsible for the vast majority of corporate “mortality,” whereas bankruptcy and liquidation historically account for merely 8% of corporate deaths (Daepf et al. 2015, p. 3). This leads to a striking continuity in corporate capital over time and renders surviving firms worthwhile objects of economic investigation. Moreover, according to the granular hypothesis (Gabaix 2011, Acemoglu et al. 2012), long-lived corporations are relevant for understanding how sizable

economy-wide fluctuations can arise from idiosyncratic shocks to the largest and most interconnected firms in the economy. Concerns of survivorship bias, however, have traditionally prevented exclusive interest in the subset of long-lived firms, and so far, we know surprisingly little about the granular capital that has accumulated over time in surviving corporations.¹ To fill this void, Alfarano et al. (2012) and Mundt et al. (2016) have studied the distributional and temporal properties of survivors' ROA, finding both to be remarkably stable over time and across firms.

The present paper makes three additional contributions. First, we show that this stability originates from the ergodicity of corporate ROA (for a recent discussion of ergodicity and the historical disregard for it in most economic models, see Peters 2019). Using a heterogeneous sample of firms across nearly all industries of the U.S. economy, we motivate the ergodic hypothesis by showing that firm-specific estimates of average profitability and volatility converge to the cross-sectional expectation and dispersion of ROA when survival time becomes sufficiently large.² A corollary to the ergodic hypothesis is that the evolution of survivors' ROA can be characterized by a stochastic process, first introduced by Alfarano et al. (2012) in the form of a stochastic differential equation (SDE), that is the same for all surviving corporations. We interpret this SDE as a reduced-form model of competition in the classical sense of a perpetual reallocation of capital in search of abnormal profits, ultimately resulting in a constant dispersion of ROA around a systemic rate of return.

Second, we provide an empirical assessment of the ergodic hypothesis and test its stark and unexpected implication that corporate idiosyncrasies are irrelevant for the time evolution of surviving corporations' profitability. Our results support the coincidence of cross-sectional and individual time series distributions of ROA and testify to a uniform long-run rate of profit and, even more unexpectedly, an almost uniform volatility in surviving capital.

Third, we reconcile our findings with previous work by investigating whether the profitability of shorter-lived firms is also independent of idiosyncrasies. Contrary to long-lived firms, dependencies between profitability and corporate characteristics clearly do exist for shorter-lived firms, explaining the different views in the extant literature (detailed in the online appendix, Section A.1) that usually considers heterogeneous mixtures of surviving and shorter-lived firms.

2. Data

Our data are taken from Datastream Worldscope and consist of 5,314 publicly traded U.S. companies. The unbalanced sample covers the period 1980–2012 and includes companies from around 600 (four-digit) Standard

Industrial Classification (SIC) industries, merely excluding banking corporations because their balance sheets differ structurally from those of other industries, which reduces the sample size by less than 1%, to 5,266 firms, with a total of 75,692 firm-year observations. Depending on the year, the number of firms in the sample varies between 543, in 1980, and 4,249, in 2008, with an average of 2,293 observations per year. Considering the individual time series, the average firm remains in the surveyed population for approximately 14 years, and 498 firms in the sample survive over the entire period 1980–2012. Although these firms represent merely 9.5% of firms in the sample, they account, on average, for 72% of total assets, 75% of market capitalization, and 74% of employment in the sample.

At the center of our investigation are annual corporate profit rates, measured by the ratio of operating income to total assets in a given year, and henceforth denoted by $x \in \mathbb{R}$. Regarding individual corporate characteristics, we retrieve additional variables including common equity, total liabilities consisting of long-term and short-term debt, sales, number of employees, and stock market prices. To investigate the effect of industry concentration on corporate profitability, we employ four-digit SIC codes.

As concerns of survivorship bias have obstructed exclusive interest in long-lived firms, the explicit focus on surviving (and mostly granular) capital is a major novelty in the present study. The sample period includes different phases of the business cycle and even several crises, so our results should not be driven by the choice of sample period. In addition to surviving corporations, the sample also includes a large number of shorter-lived firms with heterogeneous life spans, and we will argue that sample heterogeneity is crucial for understanding the divergent views between our study and prior work. Finally, the sample covers a wide range of different industries and provides a rather comprehensive view of the U.S. economy.

3. Motivation of the Ergodic Hypothesis

To motivate the ergodic hypothesis, we study our data from a time series perspective and a cross-sectional perspective, focusing on the role of survival for the observed regularities. The two perspectives provide complementary views on the profitability of companies. Whereas the cross-sectional ROA distribution defines the space of possible outcomes and their respective probabilities at a given point in time, the ROA time series is more relevant for stakeholders, as it captures individual destinies over time. If the time series moments vary across firms and potentially relate systematically to firms' individual characteristics, the cross-sectional moments will not represent individual destinies and lead to a nonergodic system. Only under ergodicity can we employ the cross-sectional distribution in a given year to draw inferences

on individual trajectories because both perspectives are then equivalent.

First we consider the cross-sectional properties of corporate profitability in Figure 1 and compare the results for entrants (panel (a)) and survivors (panel (b)). The cross-sectional ROA distribution for entering firms is asymmetric and contains significantly more mass in the left tail, even 20 years after entry, showing that relatively new firms are more likely to exhibit low or even negative profitability. The cross-sectional distribution for the 498 companies that survive over the entire sample period of 1980–2012 is symmetric and reasonably approximated by the Laplace distribution

$$L(x; m, \sigma) = \frac{1}{2\sigma} \exp\left(-\left|\frac{x - m}{\sigma}\right|\right), \quad (1)$$

suggesting that the profitability of survivors fluctuates with equal probability around the “systemic” rate of profit m .³ To illustrate the time stability of this empirical regularity conditional on survival, Figure 1(b) shows the distribution for seven equidistant years of the sample period, and also reports the annual maximum likelihood (ML) estimates of the location parameter m and the scale parameter σ for all years from 1980 to 2012. The ML estimators correspond to the sample median and the sample mean absolute deviation from the median (see, e.g., Kotz et al. 2001). Because both the functional form and the parametrization of this distribution are stable over time, the different annual distributions virtually collapse upon the same curve as in Figure 1(b), suggesting that the state space is invariant conditional on survival. We thus pool the ROA realizations of all surviving firms across all years

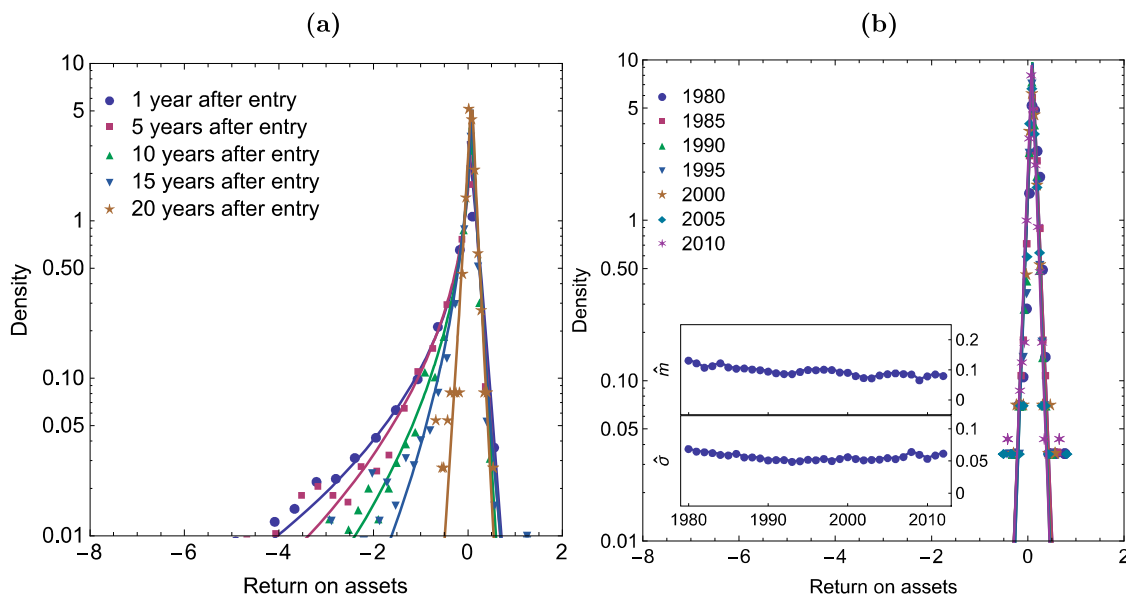
and obtain parameter estimates $\hat{m} = 0.0947 \pm 0.0005$ and $\hat{\sigma} = 0.0581 \pm 0.0005$, henceforth referred to as the phenomenological values of the location and scale parameters, so the cross-sectional median ROA of surviving corporations is around 9.5% per year with a cross-sectional mean absolute deviation of around 5.8% per year.

A perspective complementary to the cross-sectional analysis in Figure 1 is provided in Figure 2, which shows estimates of the median and the mean absolute deviation obtained from individual time series as functions of the survival time τ . Our main point here is that for increasing survival times, the individual time series moments are not only less dispersed across firms but also converge to the phenomenological values obtained from the cross-sectional distribution, shown as horizontal lines in Figure 2. Although consistent with the ergodic hypothesis, this finding is at odds with the idea that average profitability and volatility depend systematically on industry- and firm-level specificities. The latter would imply that firm-specific moments converge to different long-run values and that the cross-sectional distribution of ROA is not representative of individual time series.⁴ In contrast, new firms exhibit substantial variation in their time series moments over the first 20 years of their life span, indicating that ergodicity applies only to the profitability of surviving corporations.

4. Reduced-Form Model

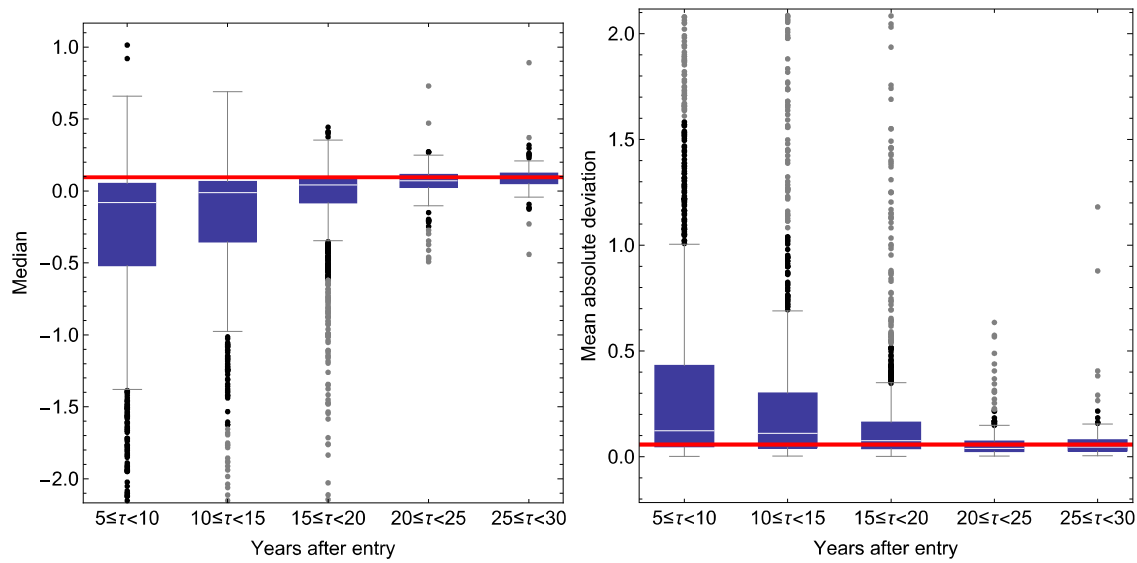
This section reviews a rather general model of survivors’ profitability that is consistent with the ergodic hypothesis. The model encodes the dynamics of corporate profitability

Figure 1. (Color online) Cross-Sectional ROA Distribution for (a) Entrants and (b) Surviving Companies



Notes. Solid lines in (a) represent a fit with an asymmetric exponential power distribution (Bottazzi and Secchi 2011), whereas the distributions in (b) are fitted with the symmetric Laplace distribution in Equation (1). Parameter estimates of the latter are shown in the inset of panel (b).

Figure 2. (Color online) Box Plots of Time Series Median and Mean Absolute Deviation from the Median as Functions of Years After Entry



Note. The horizontal lines represent the phenomenological values (left) $\hat{m} = 0.0947 \pm 0.0005$ and (right) $\hat{\sigma} = 0.0581 \pm 0.0005$ of the pooled cross-sectional profit rate distribution for surviving firms.

through a mean-reverting stochastic differential equation with a stationary Laplace density, built on the classical idea that competition tends to equalize ROA. The number of stochastic processes that have the Laplace distribution in Equation (1) as the stationary density is in principle infinite. Heeding the dictum of parsimony and relying on a considerable analytical apparatus that is in place for SDEs, Alfaro et al. (2012) construct the following nonlinear SDE for the time evolution of ROA $\{X_{it}\}_{t=0}^T$ for firm i such that it results in a stationary Laplace density with median m_i and absolute mean deviation σ_i :

$$dX_{it} = -\frac{D_i}{2\sigma_i} \text{sgn}(X_{it} - m_i)dt + \sqrt{D_i} dW_{it}. \quad (2)$$

Equation (2) defines a regular diffusion on the real line, and the constant diffusion function $\sqrt{D_i}$ that scales the Wiener increments dW_{it} determines how rapidly the process fluctuates. Under ergodicity, the functional form of the cross-sectional and time series distributions must be the same (here, stationary Laplace) so that the firm-specific parameters m_i and σ_i in Equation (2), representing the individual time series of firm i , must be replaced with the cross-sectional parameters m and σ from the ensemble distribution in Equation (1), that is, $m_i = m$ and $\sigma_i = \sigma$ for all $i = 1, \dots, N$, leaving D_i as the only source of idiosyncratic variation in the time evolution of profitability.⁵

From an economic viewpoint, the process can be interpreted as a reduced-form model of dynamic competition in the classical sense of a perpetual reallocation of capital in search of abnormal profits, which

leads to a tendency for profit rate equalization that is captured by the mean-reverting first term. The fact that D_i shows up in both the deterministic drift and the random diffusion function suggests that competition simultaneously generates persistent fluctuations in corporate profitability and convergence to the systemic profit rate m . Large values of D_i simultaneously lead to substantial fluctuations in profitability and a faster convergence to m , whereas small values of D_i lead to lower fluctuations and a slower convergence to m . Fast convergence to m with small fluctuations is therefore not a feasible scenario. Although D_i does not affect the stationary outcome in Equation (1), it determines the individual persistence of fluctuations around m , and Mundt et al. (2016) find negative correlations between D_i and firm size, diversification, and capital intensity, implying that corporate characteristics have an impact on how quickly abnormal profits dissipate.

5. Testing the Ergodic Hypothesis

To assess the empirical validity of the ergodic hypothesis, we test whether annual cross-sectional and individual time series distributions of corporate ROA are indeed statistically indistinguishable conditional on survival. We employ the two-sample Kolmogorov–Smirnov (KS hereafter) test because it does not depend on the functional form and particular parametrization of the distributions under scrutiny. The persistence and mean reversion in corporate profitability lead to significant autocorrelations, so the standard critical values of the KS test need to be

modified because they are highly sensitive to serially correlated data (Weiss 1978). To address this problem, we compute firm-specific critical values from Monte Carlo simulations of our reduced-form model that account for individual autocorrelations in ROA through the drift function (see Section A.2 in the online appendix for details).

We then compute the KS statistics for all pairs of firm time series and annual cross-sectional distributions from 1980 to 2012. Under ergodicity, a rejection of the null hypothesis for a time series and the cross-sectional distribution of a given year implies rejections for that time series and all annual cross-sectional distributions. Put differently, firms that are rejected in a given year should be rejected in all other years as well. Conversely, firms that are not rejected in a given year should never be rejected. Thus we expect that 5% of firms are rejected under the ergodic hypothesis for all years considering a significance level of 5%. Empirically, we detect some deviations from this idealized scenario. In fact, we observe that 34 out of 498 firms (or 6.8%) are rejected for more than 30 years.⁶

A rejection of the null hypothesis either stems from statistical fluctuations or from “true” violations of ergodicity. To distinguish between the two cases, we identify companies whose empirical realization of the KS statistic exceeds the maximum statistic in the respective Monte Carlo simulations.⁷ This procedure identifies 9 firms among the 34 that are inconsistent with the ergodic hypothesis, yet their destinies provide some additional insights into the competitive process and the capital reallocation mechanism. For instance, two of these firms operate below \hat{m} with a negative median ROA for the period 1980–2012, namely, Comprehensive Care and Intelligent Systems. So it is not surprising that the former did not survive for much longer, filing for bankruptcy in 2020. An example for a deviation in the opposite direction is St. Jude Medical, which operated systematically above \hat{m} and was acquired by another surviving corporation, Abbott Laboratories, in 2017. Texas Pacific Land and Great Northern Iron (GNI) are peculiar insofar as they are trusts pursuing non-scalable businesses that are largely sheltered from competition, leading to profit margins that exceed the sample average by almost one order of magnitude. GNI ceased to be a going concern in 2015, and its assets have been acquired by (a subsidiary of) the surviving corporation Conoco Phillips. The remaining four companies are Hecla Mining, Advanced Micro Devices, Deluxe Corporation, and Gap Inc.⁸ These nine “outliers” nevertheless provide anecdotes of how the market tends to eliminate long-run deviations from ergodicity through the process of capital reallocation, indicating the vital

importance of classical competition for the remarkable stability in corporate profitability.

6. Testing an Economic Implication of Ergodicity

The ergodic hypothesis implies that corporate idiosyncrasies do not affect average profitability and volatility conditional on survival. We test this implication by analyzing how or whether the median and mean absolute deviation of ROA time series relate to financial and industrial characteristics such as industry concentration, size, sales growth, market share, leverage, productivity, and market valuation. The reason why we concentrate on these particular variables is that they have been the most prevalent in prior studies of profitability (see, e.g., the meta-analysis by Capon et al. (1990), in addition to the studies in the online appendix, Section A.1). The extant literature, by avoiding survivorship bias, has found systematic influences of corporate idiosyncrasies on profitability, so our diverging views on the (ir)relevance of firm idiosyncrasies for profitability should originate from differences in sample composition.

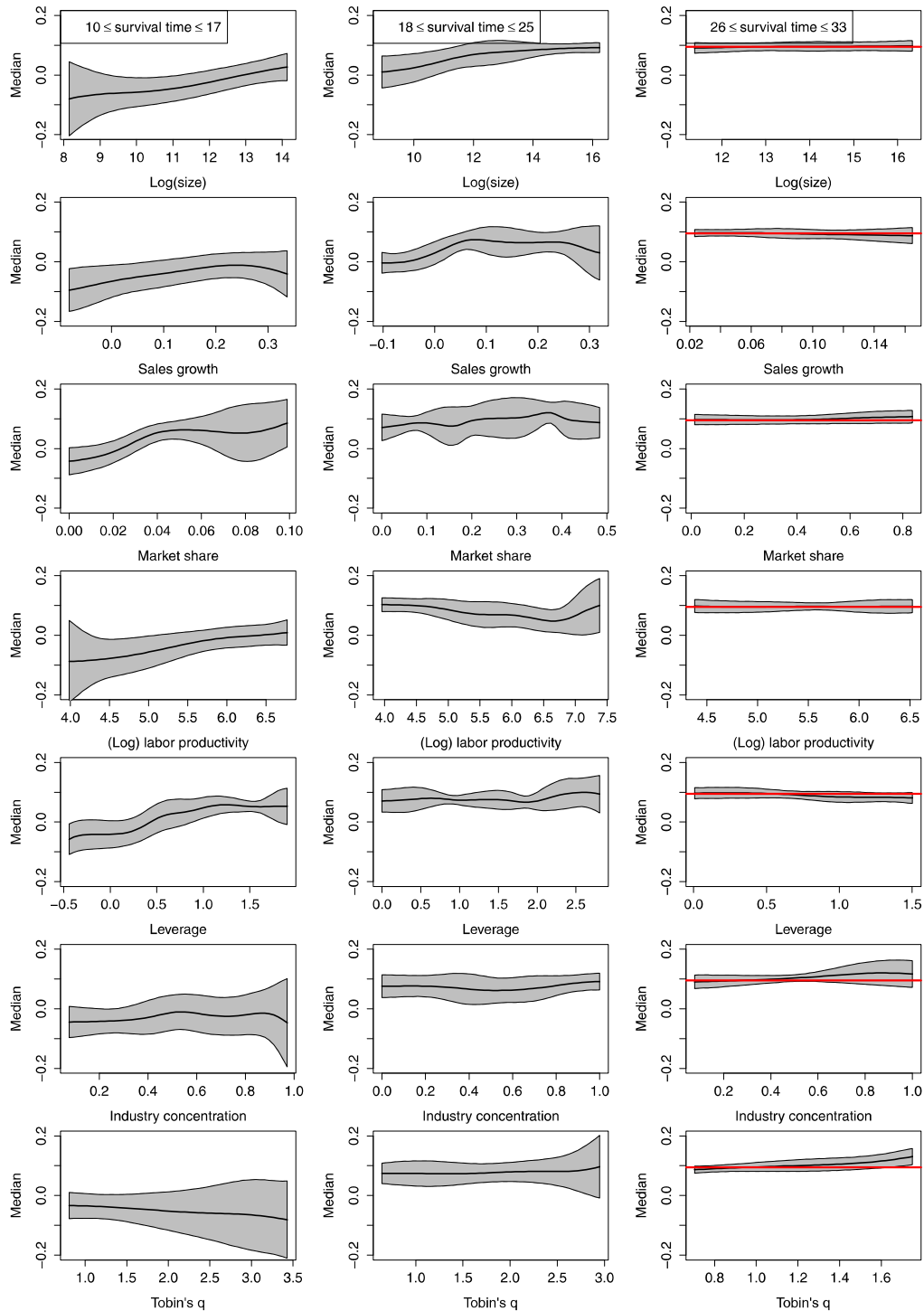
Consequently, we group firms into three subsamples such that the first group contains 1,804 firms that remain in the population for 10 to 17 years, the second group of 837 firms for 18 to 25 years, and the third group with 720 firms for 26 or more years. Then we compute the median ROA and the mean absolute deviation in ROA for every individual time series and regress each on their respective firm and industry characteristics. Because the functional form of the regression relationships is not obvious a priori, we employ a nonparametric multivariate procedure.⁹

The results in Figure 3 (for average ROA) and Figure 4 (for ROA volatility) suggest that corporate idiosyncrasies indeed correlate with the profitability of shorter-lived firms; for example, shorter-lived companies that are large or exhibit high productivity tend to be more profitable on average, and also exhibit less volatile fluctuations. The influence of these specificities is increasingly vanishing, however, as the system approaches the ergodic regime for increasing survival times.¹⁰ Thus, survivors cannot do better but also must not do worse than their competitors, both in terms of their average profitability and the volatility of their ROA series. A notable exception among the considered idiosyncrasies is Tobin's q , in line with the well-known dichotomy between “real” variables and financial market valuations.

7. Discussion

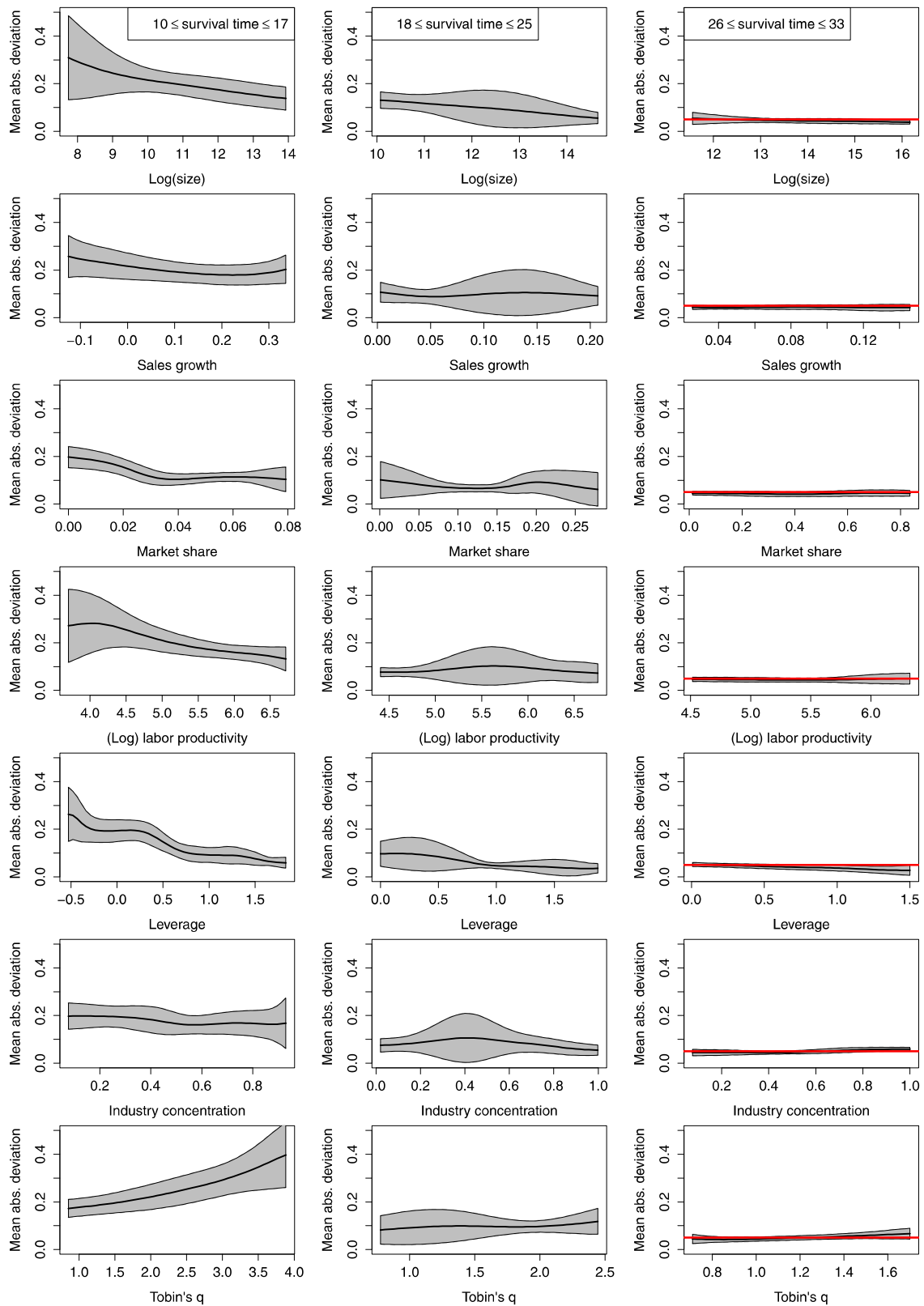
Our findings have consequences for managers, investors, and society at large, and lead to new and up to now unresolved questions. Yet our approach certainly

Figure 3. (Color online) Partial Nonparametric Regression Plots (Outcome vs. One Covariate, Holding All Other Covariates Constant at Their Median Values) for the Median Profit Rate, Conditional on the Number of Years That Firms Survive in the Sample



Notes. The left panel shows firms with 10 to 17 observations, the middle panel those with 18 to 25 observations, and the right panel those with more than 25 observations. The 95% confidence bands are adjusted for multiple testing using the Bonferroni method. The independent variables are (the time series median of) firm size (total assets), growth of sales, market share (on a four-digit SIC level), labor productivity (sales per employee), leverage (the ratio of the sum of short-term and long-term debt to common equity), the Herfindahl industry concentration measure, and Tobin's q (the ratio of the sum of book value of debt and the market value of equity to total assets). The horizontal line in each panel on the right shows the phenomenological value of the location parameter.

Figure 4. (Color online) Partial Nonparametric Regression Plots for the Mean Absolute Deviation of Profit Rates, Conditional on the Number of Years That Firms Survive in the Sample



Note. The horizontal line in each panel on the right illustrates the phenomenological value of the dispersion parameter.

has important limitations as well, because it can neither predict survival nor what will happen to young, small, or private firms. Furthermore, it remains to be seen whether the ergodic hypothesis also applies over the entire period of corporate capitalism, dating back to the middle of the 19th century, and not just to the period we covered here.

Our results have important implications for business strategy, especially for businesses that put value on their own long-term survival. Our inability to reject the hypothesis that long-run survivors are on average equally profitable and experience equally volatile fluctuations suggests that these features are necessary conditions for long-run survival. A likely mechanism is that competition, in the classical sense of a perpetual reallocation of capital in search of abnormal profits, implies that firms do not survive unless they maintain a sufficient return on capital. Although prolonged upward deviations from this uniform long-run rate of profit would be consistent with survival, they appear impossible to maintain in competitive product markets and with antitrust authorities supposedly curtailing monopoly rents. Hence, our results suggest (i) that long-term survival requires profitability at least equal to the uniform long-run profit rate, and (ii) that even survivors cannot sustain profitability above that long-run rate for prolonged periods of time.

Another, rather provocative, interpretation of our findings could be that survival apparently confers a certain privilege that leaves no room for the risk–return trade-off we have grown accustomed to. Firms probably do not survive for long, however, unless they manage to avoid excessively large downward fluctuations, and this necessity might well entail a desperate daily struggle for a competitive edge, rather than a cozy privilege. At any rate, managers of both incumbent and new firms might want to understand how various idiosyncrasies affect the probability to survive rather than how they affect profitability itself, and a growing body of literature has already started to investigate how industry or firm characteristics impact the probability of survival (see, e.g., Agarwal and Gort 1996, 2002; Bayus and Agarwal 2007). Our findings provide a new perspective for research into strategic mechanisms that increase the probability of survival as they quantify the performance that survival necessitates or, perhaps, the reward that it confers. Because the destinies of outliers in Section 5 suggest that the market tends to eliminate persistent deviations from this long-run regularity either by bankruptcy and liquidation or by mergers and acquisitions, our approach may help to identify companies that are potential takeover targets or are threatened by bankruptcy. Another immediate application of this regularity is forecasting (Mundt et al. 2020), with the important qualification that the evidently

superior forecasting performance of our process is conditional on survival and thus limited in practice.

Investors, on the other hand, will notice that the annual average profitability of surviving firms coincides with the long-term annual return to the S&P 500, but the historical volatility of annual financial returns is almost an order of magnitude higher compared with the volatility of real returns produced by surviving corporations. Viewed from this perspective, financial volatility seems to be the premium that investors have to pay for the liquidity and divisibility of financial investment relative to the frictions and commitment that real activity necessitates. The operationalization of our results for long investment horizons is straightforward because exchange-traded funds (ETFs) on a broad index like, say, the S&P 500 are rebalanced periodically, passively yielding a portfolio that comes close to a portfolio of survivors by construction, albeit forgoing the large abnormal returns of successful dynamic newcomers by construction as well. Be that as it may, our results illustrate that abnormally large returns cannot scale beyond a certain survival time, rendering investment in a portfolio of survivors through ETFs a scalable long-term financial strategy at low cost.

The most pressing issue in the eyes of the public is probably whether the stability in surviving capital has sociopolitical, environmental, or economic costs attached to it. Put differently, does the stability in survivors' profitability entail considerable fluctuations and adjustments in other parts of the economy? Eeckhout (2021) argues in his recent book that corporations have significantly increased their market power over the period we study here, and he provides an unsettling account of economic developments and policies that have been "pro business" rather than "pro market," with suppressed wages across the board as an important means in generating or maintaining corporate profits. A historical perspective on ROA over the entire period of corporate capitalism, including different crisis periods and regimes of antitrust enforcement, would certainly be helpful in deciding on this issue in the ergodicity context.

Finally, our investigation shows that the profitability of entering companies is nonergodic and thus correlated with firm characteristics, even 25 years after entry, implying that firm-specific patterns in profitability prevail in the short and medium run, and thus obviously merit the extensive consideration they have received in the literature, especially because the survival time of the average U.S. corporation is below 25 years and has markedly decreased over the last 70 years (Foster and Kaplan 2001). After all, managers and investors might still want to realize that prolonged survival apparently prevents sustained deviations from the systemic rate of profit and its volatility.

Acknowledgments

The authors are indebted to Dirk Jenter, for his valuable suggestions at crucial junctures of this investigation, and thank Christian Babirat, Giulio Bottazzi, Ilfan Oh, Jan Schulz, and three anonymous referees for their helpful comments, as well as Lukas Eggersdorfer, Nicolas Klas, Laura Linhardt, and Marius Theiler for their able research assistance. P. M. expresses his gratitude to Universitat Jaume I for its hospitality on various occasions during the investigation.

Endnotes

¹ As far as corporate survival is concerned, the contested questions have typically revolved around whether executives prioritize the maximization of profits over survival or whether they even care for corporate survival. Previous contributions show that survival is both of theoretical and empirical relevance. Dutta and Radner (1999) demonstrate under reasonably weak assumptions that profit-maximizing corporations will go bankrupt almost surely in finite time such that over longer horizons, none of the surviving firms could have been maximizing profits, whereas Oprea (2014) shows in a closely related experimental setup that individual subjects exhibit a widespread bias toward survival even after controlling for standard risk aversion.

² Actually, we are not aware of other economic or financial observables that exhibit the ergodic property. It is well known, for example, that the volatility of firm growth rates depends on firm size (Stanley et al. 1996, Bottazzi and Secchi 2003), even for surviving firms (Mundt et al. 2016), suggesting that time series moments of growth rates vary systematically across companies and thus do not coincide with cross-sectional moments.

³ Prior work confirmed the Laplacian shape of the cross-sectional ROA distribution based on different goodness-of-fit tests (see, e.g., Alfarano et al. 2012, Mundt et al. 2020).

⁴ Using an almost identical data set, Livan et al. (2014) show that cross-sectional correlations in the profitability of surviving corporations are negligible. This rules out the alternative interpretation that the remarkable homogeneity in survivors' time series moments is merely an artifact of cross-sectional correlations.

⁵ Note that stationarity of a process does not imply ergodicity, as a simple counterexample illustrates. For instance, Equation (2) would not be consistent with an ergodic system if the ROA time series of n firms, indexed by i , were samples from different stationary Laplace distributions with firm-specific parameters m_i and σ_i . In this case, the ROA time series of each firm would have its respective stationary Laplace distribution, but the system would be nonergodic because the cross-sectional distribution depends on the distribution of m_i and σ_i , and is thus not representative of either of the N firms.

⁶ Note that this procedure is not overly sensitive to a different choice of this threshold. For example, we count 51 (or 10.2% of) firms with more than 25 rejections.

⁷ The maximum statistic exceeds the 95% quantile of the simulated null distribution by a factor of 1.02 to 2.76, depending on the diffusion coefficient.

⁸ Although a detailed analysis of the few peculiar survivors that appear nonergodic is beyond the scope of this article, it is perhaps still instructive to note that they oftentimes engage in sequences of very large acquisitions and divestments with substantial effects on asset turnover, or, as in the case of Hecla, benefit from silver short squeezes and are exposed to the extremely volatile environment of speculative mining.

⁹ The online appendix, Section A.3, provides technical details of the procedure for the Nadaraya–Watson estimator. A complementary analysis using partial correlation coefficients instead of the non-parametric regressions reported here is in the online appendix, Section A.4.

¹⁰ This is also true if we study profitability as a function of the change in firm size from 1980 to 2012, as suggested by one of the referees.

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