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Abstract

This paper reports an analysis of distributional properties of two fundamental measures of profitability - profit rate, measured as return on assets, and Tobin's q - for the group of 1095 long-lived Japanese (non-financial) listed firms over the 1971-2012 period. A series of our empirical analysis reveals that the empirical density of profit rates approximately obeys the Laplace distribution, the result of which holds independently of time dimension and sectoral characteristics in an approximate sense. This paper also reports that there is no unique theoretical distribution that captures the key distributional properties of Tobin's q, measured in logarithmic scale, a potential cause of which lies in the highly volatile nature of the tail behavior expressed by the annual empirical densities of this profitability measure.

Keywords: Japan, Laplace distribution, Long-lived firms, Model selection, Profit rate, Statistical equilibrium, Tobin's q

JEL Classification: C13, D22, C52

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1 Introduction

Identifying the determinants and dynamic properties of corporate profitability has been one of the central topics in industrial economics. The main argument in this line of research has revolved around the empirical verification of a conjecture given by the theory of competitive market which states that, in the long run, competitive force operating in an economy eliminates excess profit and equal profitability prevails over all industries and all firms. In line with a series of studies by Mueller (1977, 1986) who set out a basic research design to check the credibility of the conjecture, the vast literature has repeatedly examined the time series behavior of several profitability measures[1] over different countries, and a common finding reveals that excess profit persists over time, which formed a cornerstone of the persistence of profit (POP) approach.[2]

According to Goddard and Wilson (1999), the main aim of the POP approach is to identify the nature of competitive process by investigating the estimated parameters associated with simple empirical models projecting the time series properties of profitability at individual firm level. To this end, the majority of studies in this approach employ a common modeling framework which is characterized by a univariate first order autoregressive process:

$$\pi_{i,t} = \alpha_i + \lambda_i \pi_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

where i indexes firms, t indexes time, $\pi_{i,t}$ is a suitably normalized profit rate for firm i at time t, and $\varepsilon_{i,t}$ is an idiosyncratic error term which is *assumed* to follow the normal distribution with zero mean and time-independent variance. From the structure of model (1), it is apparent that the parameters α_i and λ_i play a significant role in capturing the properties of competitive process since the presence or absence of long run profit rate $\overline{\pi}_i$ $(= \frac{\alpha_i}{1-\lambda_i})$ is determined by the estimated values of those parameters and, in particular, the first order autocorrelation coefficient λ_i gauges the degree of competitive force in the short run which is equivalent to the magnitude of short run persistence of profit.

While some studies offered extensions and refinements of the baseline model (1) that rests on AR(1) process in several ways,[3] however, no prior literature in

[1]In the literature, the representative measures of corporate profitability cover, for example, return on assets, return on equity, return on investment, and Tobin's q.

[2]The major studies in the POP approach include, among others, Cubbin and Geroski (1987, 1990) and Goddard and Wilson (1999) for the UK; Geroski and Jacquemin (1988) for three European countries (France, Germany and the UK); Glen et al. (2001, 2003) for seven emerging markets (Brazil, India, Jordan, Korea, Malaysia, Mexico, South Korea, and Zimbabwe); Goddard et al. (2005) for five European countries (Belgium, France, Italy, Spain, and the UK); Kambhampati (1995) for India; Mueller (1990), Ismail and Choi (1996), Waring (1996), McGahan and Porter (1999), and Gschwandtner (2005) for the US; Odagiri and Yamawaki (1986) and Maruyama and Odagiri (2002) for Japan; Schwalbach et al. (1989) and Schohl (1990) for Germany. For the empirical studies on the determinants and duration of firm performance using Tobin's q in line with the POP approach, see, for example, Wernerfelt and Montgomery (1988), Wiggins and Ruefli (2002), Villalonga (2004), and McGahan (2008).

[3]For example, Cuaresma and Gschwandtner (2006) consider nonlinearity in profit rate dy-

the approach has posed a very simple question, despite its fundamental importance for inspecting the validity of any model in use within itself: is there any empirical support for the assumption of normality imposed on the distributions of profitability measures?

A recent contribution to the theory of profit rate and macroeconomics calls for a radical change in the extant modeling framework of the POP approach by demonstrating that the profit rate distribution is markedly non-Gaussian. In particular, Alfarano et al. (2012) compellingly show that, for a sample of listed firms (excluding banking sector) in the US over the 1980-2006 period, the empirical density of profit rates, measured by the ratio of operating income over total assets, is well described by the Laplace distribution that is a special case of an exponential power (or Subbotin) distribution.[4] Intertwining this significant empirical finding on a particular form of the profit rate distribution with the notion of *statistical equilibrium* starting with Foley (1994), Alfarano et al. (2012) propose a diffusion process reflecting the dynamic evolution of firm profitability and prove that this stochastic process generates the Subbotin distribution as its stationary distribution, the penetrating insight of which has not been discussed in the literature following the POP approach.

Their approach - statistical equilibrium approach to the theory of profit rate and firm competition - predicts the existence of statistical equilibrium of firm profitability, which manifests itself as a stationary distribution independent of time and cross sectional dimensions, arising from complex interactions in competitive heterogeneous firms. To reconfirm this conjecture, Mundt et al. (2015) extend the original time span covered by Alfarano et al. (2012) and continue to find the presence of Laplace distribution as a benchmark for the profit rate distribution in the case of the US over the 1980-2011 period. Their main findings suggest that the empirical regularities observable on profit rates are more stable and robust than those on firm asset growth rates and, in particular, a diffusion process proposed by Alfarano et al. (2012) well captures the dynamic behavior of profit rates, which is independent of firm size measures and sectoral characteristics. Further, using the data of Icelandic firms (excluding financial sector) over the 2000-2009 period, Erlingsson et al. (2012) report that the Laplace distribution is a good benchmark for the profit rate distribution under the phase of equilibrated growth of Icelandic economy, except for the high growth period with potential asset market “bubbles”.

The objective of this paper is to empirically compare and contrast the distributional properties of two representative profitability measures projecting firm performance - return on assets and Tobin’s q. Based on the findings in line with the statistical equilibrium approach and using the balance sheet data of listed Japanese firms, we focus our attention exclusively on investigating whether there exists a stable distribution of each measure, *independent* of the levels of aggregation. In the empirical analysis, we find: (i) the stable distribution of Tobin’s qs, measured

namics and Canarella et al. (2013) test the existence of a unit root in a linear process of several profitability measures with the use of panel unit root tests and examine “hysteretic” hypothesis based on random walk process.

[4]The literature reporting the Subbotin distribution as a benchmark for firm asset growth rate distribution includes, for example, Stanley et al. (1996), Bottazzi et al. (2001, 2002), Bottazzi and Secchi (2006), and Alfarano and Milaković (2008).

in logarithmic scale, does not seem to exist since the empirical densities of logarithm of Tobin's qs under different levels of aggregation are subject to different theoretical distributions and (ii) the empirical density of profit rates, measured by returns on assets, approximately follows the Laplace distribution and this result is immune to the levels of aggregation, which conforms to the key finding in the statistical equilibrium approach.

This paper is organized as follows. After describing the properties of data in the next section, we specify model selection criteria and a set of candidate distributions employed in our empirical analysis in Section 3. Section 4 examines the distributional properties of pooled sample of profit rates and those of logarithm of Tobin's qs. Section 5 provides robustness check for our initial findings by reproducing the empirical analysis under the different levels of aggregation. Section 6 summarizes the results and concludes.

2 Data

Our empirical analysis uses a sample of publicly traded Japanese firms for the 1971-2012 period, excluding the information of firms operating in financial sector (commercial banks, securities companies, insurance companies, and other financing businesses including credit and leasing companies). The entire sample consists of firm-year observations available on Nikkei NEEDS (Nikkei Economic Electronic Databank System) Financial QUEST database[5] (heareafter, Nikkei NEEDS) recording the *end-of-period* accounting information provided by a total of 3755 firms that have been present in the market for at least one year over the sample period. Nikkei NEEDS classifies industry into 32 segments (apart from financial sector) and assigns one of its original industry classification codes (Nikkei industrial class codes) to each individual firm. Table A1 in Appendix A reports industry definitions and the composition of individual industries.

Following Alfarano et al. (2012) and Mundt et al. (2015), this study focuses on long-lived or "surviving" firms in the sample. We define a long-lived firm as the firm that provides, over the entire sample period, the valid information of the following financial data: operating income (Nikkei Item Code: D01029); total assets (Nikkei Item Code: B01110); total sales (Nikkei Item Code: D01021 *minus* D01022, i.e., net sales including financial revenue minus financial revenue). The final sample of long-lived firms is comprised of the information of 1095 firms.

Figure 1 displays each time series of firm size measures represented by market capitalization (Nikkei Item Code: STOCK'MMKTV), total assets, and total sales,

[5]Nikkei NEEDS database covers firms listed on all stock markets in Japan, currently composed of Fukuoka Stock Exchange, Nagoya Stock Exchange, Sapporo Securities Exchange, and Tokyo Stock Exchange before and after its merger with the spot market of Osaka Securities Exchange on January, 1st, 2013. The database also includes the information of firms listed on Osaka Securities Exchange (that has specialized in providing services for derivatives trading since 2013) up to 2012. In addition, it covers unlisted companies whose annual securities reports ("Yukashouken Houkokusyo" in Japanese) have been publicly available at local finance bureaus and/or whose financial statements have been disclosed in annual securities reports of corresponding parent companies. The information of foreign companies, investment corporations, and exchange traded funds is not recorded. For further information, see Nikkei Digital Media Inc. (2013).

each of which is aggregated over long-lived firms and expressed as a fraction of nominal GDP.[6] Notice that the ratio of market capitalization over nominal GDP is shown from 1983. This is due to the unavailability of market capitalization data up to 1982.

To aid the understanding of time series pattern of each measure, the figure provides the information of major economic events, each of which would have exerted a significant impact on Japanese economy. In addition, we report that, on the whole, the time period from 1971 through 1990 for Japanese economy was the high growth period in which the average growth rate of nominal GDP was about 9% (±0.047) and, since a sudden collapse of asset prices in 1991, Japan had been trapped in the so-called "lost decade".[7] As the figure shows, the aggregate market capitalization of long-lived firms (normalized by nominal GDP) responds much more sensitively to each event of economic and financial shocks than the aggregate total assets and total sales (normalized by nominal GDP) of those firms.

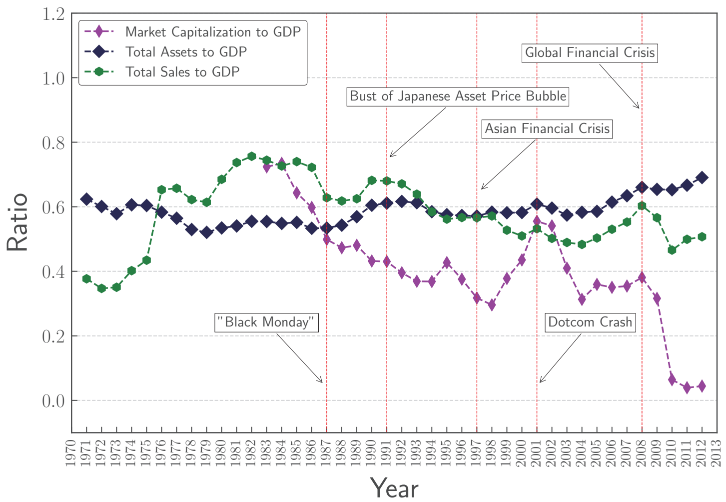

Figure 1: Time series of market capitalization, total assets, and total sales, aggregated over the group of long-lived Japanese (non-financial) listed firms, for the 1971-2012 period. Each item is expressed as a fraction of nominal GDP. Time series of the ratio of aggregate market capitalization to nominal GDP starts from 1983 due to the unavailability of market capitalization data up to 1982.

The remarkable fact illustrated in Figure 1 is the undeniable dominance of long-lived firms in the Japanese macroeconomic activity, the group of which only shares a small fraction of the total number of Japanese enterprises (e.g., 0.027% in 2012).[8] On average, the total assets and total sales of long-lived firms are more than 50% of nominal GDP (0.588 (±0.04) for total assets and 0.577 (±0.109)

[6]Time series data of Japanese nominal GDP is provided by Cabinet Office of Japan and available at: `http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/kako_top.html`

[7]For potential causes of this prolonged slowdown of Japanese economy, see, for example, Yoshikawa (2001) and Hayashi and Prescott (2002).

[8]The total number of Japanese enterprises (i.e., listed and unlisted firms) in 2012 is 4,128,215. The data is provided by Statistics Bureau of Japan and available at: `http://www.stat.go.jp/english/data/nenkan/back63/1431-06.htm`

for total sales) over the 1971-2012 period, and the market capitalization of these firms are about 40% (±0.166) of nominal GDP for the 1983-2012 period. This fact strongly suggests that penetrating the key driving forces of macroeconomic activity requires understanding the movements of these large firms, which is in support of the "granular" hypothesis proposed by Gabaix (2011) who reports that "(T)he idiosyncratic movements of the largest 100 firms in the United States appear to explain about one-third of variations in output growth." We thus believe that the dominant presence of long-lived firms in macroeconomic activity indicated by Figure 1, together with the "granular" view, justifies our focus on these firms in this study.

As a preliminary inspection of time series behavior of firm profitability measures, we briefly explore the properties of average movements of profit rate and Tobin's q. In our entire analysis, profit rate is defined as return on assets (ROA), measured by the ratio of operating income over total assets, and we use the standard definition of Tobin's *average* q, measured by the ratio of the sum of market capitalization and total liabilities over total assets.[9]

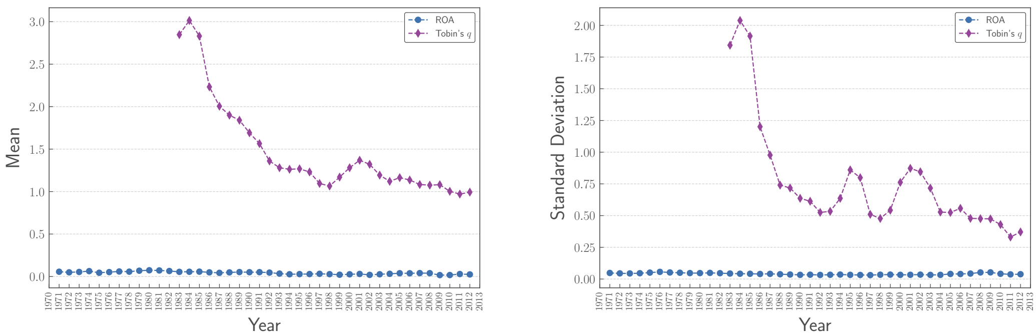

Figure 2: Time series of the sample means and sample standard deviations of profit rate and Tobin's q for long-lived Japanese (non-financial) listed firms over the 1971-2012 period. The statistics for Tobin's q start from 1983 due to the unavailability of market capitalization data up to 1982.

Figure 2 displays the means and standard deviations of profit rate and Tobin's q over the sample period. Notice that, at a first glance, the sharp decline in the average of Tobin's q for the 1984-87 period seems to be slightly puzzling since this subperiod is within the booming period (1971-1990) of Japanese economy as we reported above. However, this event is not surprising. Over this short period, the average growth rates of total assets, total liabilities, and market capitalization are 5% (±0.03), 3% (±0.03), and -0.4% (±0.08), respectively. These figures indicate that, with a mild decline in the market valuation expressed in the stock market, the group of long-lived firms accumulated total assets *faster* than total liabilities, which is consistent with the expansion of productive assets financed by internal funds in the period of growth.

A noteworthy property of corporate profitability measures displayed in both panels of Figure 2 is the striking stability of time series of average profit rate

[9]In the following argument, we use the terms, "Tobin's average q" and "Tobin's q", interchangeably.

relative to the average movement of Tobin's q. In particular, observe that, as the right panel of Figure 2 clearly shows, the standard deviation of Tobin's q is about one order of magnitude larger than that of profit rate, which strongly indicates that these two profitability measures would be subject to very different dynamic processes.

With these initial observations in mind, the next section provides the basic information of our model selection framework to identify best approximating models that capture the key distributional properties of profit rate and Tobin's q.

3 Model selection criteria and candidate distributions

It is well known that standard goodness-of-fit tests are in large part inapplicable to comparing nonnested models fitted on the same data and do not furnish reasonable guidelines for selecting between unrejected models. In addition, in those standards, Kolmogorov-Smirnov and Cramer-von Mises tests do not consider the model complexity, reflected by the number of parameters, which implies that those tests would be liable to select a model with a larger number of parameters, showing a better fit relative to more parsimonious models. To sidestep these issues in distribution selection, therefore, we use two standard information criteria - Akaike information criterion (Akaike (1973)) (AIC) and Bayesian information criterion (Schwarz (1978)) (BIC). We employ these criteria since our analysis compares nonnested models for profit rate and logarithm of Tobin's q data.

For a given model (theoretical distribution)[10] with a vector of parameters θ, AIC and BIC are defined respectively as:

$$\text{AIC} = -2\mathcal{L}\big[\hat{\theta}|x\big] + 2k, \tag{2}$$

$$\text{BIC} = -2\mathcal{L}\big[\hat{\theta}|x\big] + k\ln[N], \tag{3}$$

where ln denotes the natural logarithm, $\hat{\theta}$ is the maximum likelihood estimator of θ based on observed data x, $\mathcal{L}[\hat{\theta}|x]$ is the log-likelihood function evaluated at $\hat{\theta}$, k is the number of parameters, and N is the number of observations.

In model selection using each of these two criteria for a candidate set, a model returning the lowest criterion statistics is preferred since, in AIC framework, this model provides the minimum of Kullback-Leibler information (or divergence) that reflects the "distance" between each model in the candidate set and the "true distribution" underlying observed data and, in BIC, this model renders the maximum of the posterior probability for each model in the candidate set to be consistent with the "true distribution" underlying data. Note that, as a comparison between definitions (2) and (3) indicates, relative to AIC, a systematic tendency to select a more parsimonious model in the candidate set is inherent in BIC since it penalizes the model complexity (the number of parameters) more strictly than does AIC, as the number of observations increases.

[10] In the following argument, we use the terms, "(theoretical) distribution" and "model", interchangeably since a theoretical distribution is a model for an observed empirical data.

Although these two criteria originated from different paradigms with partially different objectives,[11] their common aim is to identify best approximating models for observed data, which suggests that the presence of the best model jointly supported by these two criteria assures the robustness of model selection. From this viewpoint, therefore, we use both criteria complementarily.

With our preliminary inspection of the data, in order to identify the best approximating model for each measure of corporate profitability, we propose the following four distributions as our candidates in model selection: Gumbel, Laplace, normal, and skew normal distributions. By Introducing normal and Laplace distributions, we check whether the empirical densities of profit rates and logarithm of Tobin's qs are approximately symmetric, and the adoption of Gumbel and skew normal distributions is for the examination of the presence or absence of significant skewness (i.e., asymmetry) of those densities. On the configuration of this candidate set, we report that the introduction of the latter two distributions in our empirical analysis is highly *experimental*.

Among the candidate distributions, we emphasize the special importance of Laplace distribution which would be a potential benchmark for the profit rate distribution. In fact, extending a series of theoretical and empirical results on the distributional properties of firm total assets growth rates reported in, for example, Stanley et al. (1996) and Bottazzi and Secchi (2006), Alfarano and Milaković (2008) and Alfarano et al. (2012) provide a general framework for the Laplace hypothesis on profit rate distribution, according to a statistical equilibrium approach of firm competition.

In the framework, they conceptualize the tendency of profit rate equalization arising from the competitive process as a moment constraint on the underlying statistical distribution of profit rates and propose, as a measure for dispersion of profit rates from a central tendency of the underlying distribution, the standardized α-th moment given by:

$$\sigma^{\alpha} = E\big[\, |x - m|^{\alpha}\big], \ \ \alpha > 0, \tag{4}$$

where σ is a measure of dispersion, E is the expectation operator, x is the profit rate (as a random variable), and m is a measure of central tendency. Employing the Maximum Entropy Principle (MEP) proposed by Foley (1994), Alfarano and Milaković (2008) show that a variational problem of MEP under the moment constraint (4) yields a statistical equilibrium (i.e., distribution) characterized by an *exponential power* or *Subbotin* distribution:

$$f[x|m,\sigma,\alpha] = \frac{1}{2\sigma\alpha^{1/\alpha}\Gamma[1+1/\alpha]}\exp\left[-\frac{1}{\alpha}\left|\frac{x-m}{\sigma}\right|^{\alpha}\right], \tag{5}$$

where $\Gamma[\cdot]$ is the gamma function, $m(\in \mathbb{R})$ is the location parameter, $\sigma(>0)$ is the scale parameter, and $\alpha(>0)$ is the shape parameter. In expression (5), it is evident that the central characteristics of Subbotin distribution is subject to

[11] For more detailed interpretation, derivation, and comparison of AIC and BIC, see, for example, Burnham and Anderson (2002), Burnham and Anderson (2004), and Kuha (2004).

a variation in the shape parameter α. When $\alpha \to \infty$, the Subbotin tends to a uniform distribution; when $\alpha = 2$, it reduces to the normal (Gaussian) distribution; when $\alpha = 1$, it reduces to the Laplace distribution; when $\alpha \to 0$, it tends toward Dirac's δ-distribution at m.

Note that, from a viewpoint of the competitive process, the shape parameter α projects the degree of competitive force operating over the entire group of profit-seeking firms. For instance, the last case (i.e., Dirac's δ-distribution at m) in the characterization of Subbotin distribution is analogous to the unique Walrasian competitive equilibrium in which each and every firm faces the equal rate of profit. From this reasoning, we infer that a case with α approaching zero from above corresponds to the situation where firms are under higher competitive pressure, which potentially intensifies the degree of imitation and innovation in firm competition. In the process, however, the emergence of Gaussian distribution ($\alpha = 2$) reflects another exceptional case in which each and every firm acts independently of competing firm's strategic behavior and diverse interplay between firms vanishes. This inference implies that the significant deviation of observed data from the Gaussian distribution testifies to the presence of firm interaction, a notable and well-founded case of which is the Laplace distribution that is a special case ($\alpha = 1$) of Subbotin distribution. Thus, incorporating the Gaussian and Laplace distributions into our candidate set facilitates the direct empirical examination on the presence or absence of complex interaction in the process of firm competition. For a more detailed and elaborate argument of the competitive process, see Alfarano et al. (2012).

On the remaining two experimental candidates for examining the presence or absence of significant skewness (asymmetry) in profit rate and logarithm of Tobin's q data, we briefly provide some of their key properties. To fix the notation for these two cases, let $x (\in \mathbb{R})$ denote a random variable.

The Gumbel distribution (for the maximum extreme value) is defined by:

$$g[x|\mu_g, \sigma_g] = \frac{1}{\sigma_g} \exp\left[-\left(\frac{x - \mu_g}{\sigma_g} \right) \right] \exp\left[- \exp\left[-\left(\frac{x - \mu_g}{\sigma_g} \right) \right] \right], \tag{6}$$

where $\mu_g (\in \mathbb{R})$ is the location parameter and $\sigma_g (> 0)$ is the shape parameter. The Gumbel distribution (for the maximum extreme value) is defined over the entire real line, unimodal, and right-skewed (i.e., positively skewed). Note that this distribution is a special case of the generalized extreme value distribution and known alternatively as type-I generalized extreme value distribution. We do not incorporate type-II and type-III extreme value distributions (Fréchet and Weibull distributions, respectively) into our candidate set since the former has the lower bound and the latter has the upper bound on x. For a more detailed description of Gumbel distribution, see Kotz and Nadarajah (2000).

On the other hand, the skew normal distribution is defined by:

$$\eta[x|\mu_\eta, \sigma_\eta, \alpha_\eta] = \frac{2}{\sigma_\eta} \phi\left[\frac{x - \mu_\eta}{\sigma_\eta} \right] \Phi\left[\alpha_\eta \left(\frac{x - \mu_\eta}{\sigma_\eta} \right) \right], \tag{7}$$

where $\mu_\eta (\in \mathbb{R})$ is the location parameter, $\sigma_\eta (> 0)$ is the scale parameter, and $\alpha_\eta (\in \mathbb{R})$ is the shape parameter. ϕ and Φ in (7) denote the probability density function (pdf) and cumulative distribution function (cdf) of the standard normal distribution, respectively. The skew normal distribution is defined over the entire real line, unimodal, and, when the shape parameter $\alpha_\eta = 0$, it reduces to the normal distribution with mean μ_η and variance σ_η^2. Its skewness (in absolute value) is proportional to the shape parameter α_η (in absolute value) and the direction of its skewness is subject to the sign of α_η. When $\alpha_\eta > 0$ (< 0), the distribution is right-skewed (left-skewed). For a more detailed description of skew normal distribution, see Azzalini (2014).

Given the information of our candidate set, we first examine whether there exists an approximately stable distribution for each sample of profit rates and logarithm of Tobin's qs at the highest level of aggregation.

4 Distributional properties of corporate profitability measures: Pooled sample

Figure 3 displays pooled empirical densities (in semi-logarithmic scale) of profit rates (the 1971-2012 period: left panel) and logarithm of Tobin's qs (the 1983-2012 period: right panel) for the group of long-lived Japanese firms.

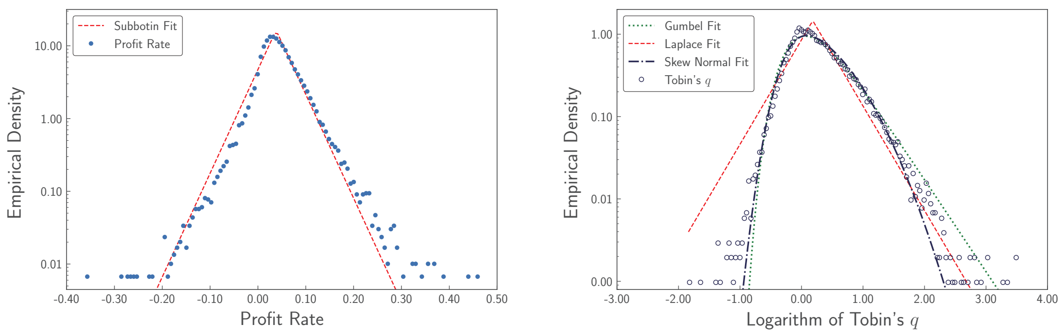

Figure 3: Pooled empirical densities of profit rates (45990 observations: left panel) for 1095 long-lived Japanese (non-financial) listed firms over the 1971-2012 period and logarithm of Tobin's qs (28924 observations: right panel) for the same class of firms over the 1983-2012 period. Tobin's q data is only available from 1983 due to the unavailability of market capitalization data up to 1982. In the left panel, the dashed curve shows the Subbotin distribution fit using maximum likelihood estimation. In the right panel, the dotted, dashed, and dash-dotted curves illustrate the Gumbel, Laplace, and skew normal distribution fits, respectively.

For the profit rate sample, the median (mode) of its pooled empirical density is 0.038 (0.022) and the Subbotin distribution fit using maximum likelihood estimation renders the following parameter values: the location parameter $m = 0.038$ (± 0.00016), the scale parameter $\sigma = 0.0306$ (± 0.00016), and the shape parameter $\alpha = 1.0132$ (± 0.008). Note that the median value of profit rate distribution coincides with the estimated location parameter, and the shape parameter estimate indicates that the distribution conforms to the Laplace hypothesis ($\alpha = 1.0$) with the very reasonable degree of accuracy, which is also visually confirmed by left panel of Figure 3. At this level of analysis, therefore, we conjecture that the Laplace distribution (i.e., a special case of Subbotin distribution) is a sound potential benchmark for the profit rate distribution, which is in line with the observations reported in Alfarano et al. (2012) and Mundt et al. (2015).

On the other hand, right panel of Figure 3 strongly suggests that the empirical density of logarithm of Tobin's qs is highly skewed with a long tail in the positive direction. To check this casual inspection, we performed D'Agostino skewness test (D'agostino et al. (1990)) and the test result rejects the null hypothesis that the sample is drawn from the Gaussian distribution (p-value = 0.00). Thus, our choice for the best approximating distribution upon the pooled density of logarithm of Tobin's qs is confined to a pair of Gumbel and skew normal distributions.

For the sample of logarithm of Tobin's qs, while its pooled density returns the sample mean = 0.2627 (±0.4522) and sample median = 0.1831, the maximum likelihood estimation of these statistics corresponding to Gumbel and skew normal distributions yields the following values. (i) Gumbel: mean = 0.2800 (±0.4976); median = 0.1982, (ii) skew normal: mean = 0.2695 (±0.4445); median = 0.2135. Along with the parameter estimates reported in Table 1, these results indicate reasonable fits of Gumbel and skew normal distributions to the empirical density of logarithm of Tobin's qs.

	Theoretical Distribution			
Parameters	Gumbel	Laplace	Normal	Skew Normal
Location Parameter	0.056 (0.002)	0.183 (0.002)	0.263 (0.003)	-0.241 (0.004)
Scale Parameter	0.388 (0.002)	0.342 (0.002)	0.452 (0.002)	0.677 (0.004)
Shape Parameter	-	-	-	2.897 (0.049)

Table 1: Maximum likelihood estimates of the parameters corresponding to candidate distributions for the pooled sample of logarithm of Tobin's qs over the 1983-2012 period. Standard errors are in parentheses. Shape parameters for the Gumbel, Laplace, and normal distributions are unavailable since each of these theoretical distributions is characterized as a two-parameter distribution.

Now, we are in a position to identify best approximating distributions for the samples of profit rates and logarithm of Tobin's qs at the highest level of aggregation, by employing model selection approach that strengthens (or weakens) our initial guess and reasoning. For the sample of profit rates, Table 2 shows the consistency between the results returned from AIC and BIC, which provides good support for the Laplace distribution as a benchmark for the pooled sample of this firm profitability measure.

On the pooled empirical density of logarithm of Tobin's qs, the consistent results under AIC and BIC reported in Table 2 suggest that the skew normal distribution is the best approximating distribution in the set of candidate distributions.

To verify our speculation at this stage of analysis from a different angle, we perform additional empirical exercises for identifying best approximating distributions for profit rates and logarithm of Tobin's qs, by investigating whether the annual distributions of each profitability measure are in agreement with the selected benchmark distribution corresponding to the pooled sample of each measure.

As a starting point of these exercises, we deal with the visual inspection of annual empirical densities of these profitability measures. Figures B1 and B2 in Appendix B display the annual distributions of profit rates and logarithm of Tobin's qs over the corresponding sample periods, respectively .

AIC & BIC Statistics	Theoretical Distribution				Selection
	Gumbel	Laplace	Normal	Skew Normal	
AIC: Profit Rate	-123777.543	-165380.112	-157024.116	-158167.528	Laplace
BIC: Profit Rate	-123760.071	-165362.640	-157006.643	-158141.320	Laplace
AIC: Tobin's q	33905.459	35924.760	36182.529	32927.287	Skew Normal
BIC: Tobin's q	33922.004	35941.305	36199.074	32952.104	Skew Normal

Table 2: Akaike information criterion (AIC) and Bayesian information criterion (BIC) statistics for the pooled samples of profit rates and logarithm of Tobin's qs. Selection criterion for best approximating theoretical distribution is based on the lowest AIC and BIC scores.

On the whole, each annual density of profit rates in Figure B1 displays an approximately symmetric and leptokurtic shape ("linear tent shape") which is a key characteristic of the Laplace distribution. On the other hand, Figure B2 indicates the unstable distributional properties of logarithm of Tobin's qs. Relative to the case of profit rate sample, the essential measures (e.g., central tendency, dispersion, and skewness) that characterize the empirical density of logarithm of Tobin's qs are subject to wild fluctuations over the sample period. In particular, there seems to be a qualitative change in the distribution around 1991, where the annual density of logarithm of Tobin's q starts to display a much more leptokurtic shape than the skew normal distribution.

From the visual observations on annual empirical densities of each profitability measure, we infer that (i) the profit rate distribution approximately follows the Laplace distribution, the property of which holds under annual disaggregation of the pooled sample and (ii) there is no unique theoretical distribution, in our candidate set, that explains the pooled sample and annual samples of logarithm of Tobin's qs in a unified manner.

In fact, the results of model selection in Appendix C confirm our inference. On the problem of model identification for annual profit rate samples, Tables C1 and C2 report information criteria statistics and associated best approximating distributions under those criteria. As both tables show, more than 95% of model selection results support the Laplace distribution as a benchmark for the profit rate distribution over the sample period (1971-2012).

On the other hand, the results for logarithm of Tobin's qs are mixed. For instance, while the results from model selections for the pooled sample (reported in Table 2) consistently support the skew normal distribution as a benchmark, Table C3 shows that, over 16 (53%) out of 30 years of the sample period (1983-2012), the AIC statistics support the Laplace distributions as the best approximating model, and the skew normal distribution is only selected for 8 (27%) out of 30 years. Further, the model selection results under BIC for the annual samples in Table C4 show that the Gumbel distribution is the best approximating distribution for the *entire* sample period of 1983-2012, the result of which is potentially due to the high penalty imposed on the model complexity in BIC approach. These results are totally inconsistent with the result obtained for the pooled sample, which reinforces our doubt on the existence of stable distribution for logarithm of Tobin's qs.

As we have seen above, the model selections under two information criteria confirm the presence of unique profit rate distribution which is approximately independent of time dimension. To check the robustness of this result, we deal with the final exercise in this section by examining the properties of maximum likelihood estimates of the parameters corresponding to the Subbotin distribution for the annual samples of profit rates.

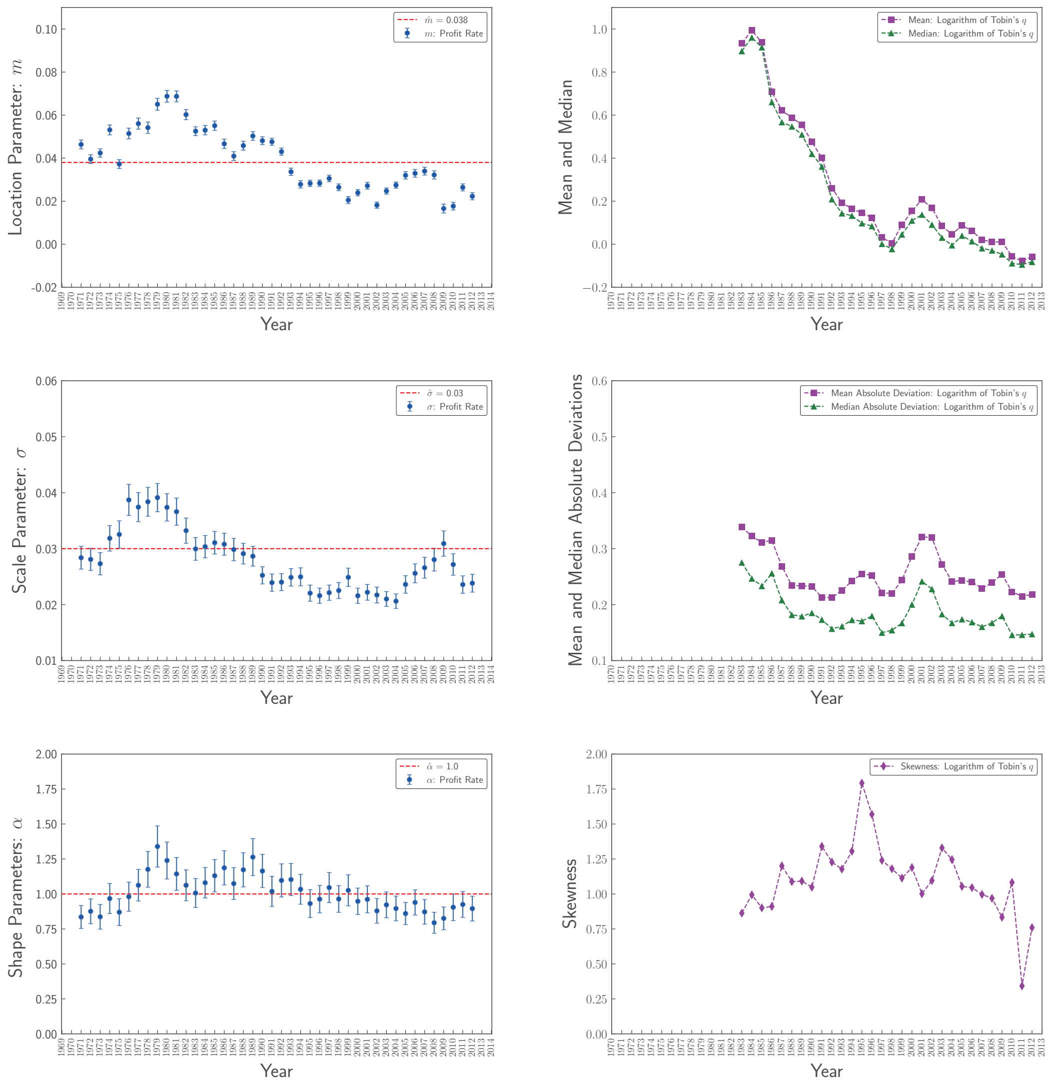

Figure 4: Year-by-year maximum likelihood estimates of the parameters corresponding to the Subbotin distribution for the annual samples of profit rates, and measures of central tendency, dispersion, and skewness for the annual samples of logarithm of Tobin's qs. For the Subbotin parameter estimates of the profit rate densities, error bars display two standard errors.

Top through bottom left panels of Figure 4 display annual maximum likelihood estimates of the location (m), scale (σ), and shape (α) parameters corresponding to the Subbotin distribution for the annual densities of profit rates, respectively. For this profitability measure, we regard the location and scale parameters estimated from the pooled sample with the shape parameter conforming to the Laplace hypothesis ($\hat{\alpha} = 1.0$) as *benchmarks*. Thus, each panel on the left-hand side of Figure 4 renders the information of corresponding benchmark parameter value.

On the annual samples of logarithm of Tobin's qs, due to the unavailability of a unique theoretical distribution at this level of analysis and for the sake of approximate comparison with distributional properties of profit rates, we provide the information of two measures of central tendency (mean and median), two dispersion measures (mean and median absolute deviations), and a measure of asymmetry (skewness statistics). As dispersion measures of the annual densities of logarithm of Tobin's qs, we opt for mean and median absolute deviations since the use of these two measures allows a sensible comparison to the scale parameter σ associated with each annual sample of profit rates under our key hypothesis of Laplace distribution in which the dispersion measure boils down to the first moment of absolute deviation derived from equation (4).

As shown in top left and right panels of Figure 4, two corporate profitability measures exhibit considerably different time series patterns over the sample period. While time series of the location parameter for the profit rate distribution shows fluctuating movement around the benchmark parameter value (3.8%) with a mildly declining trend, two measures of central tendency for logarithm of Tobin's qs jointly display the sharply declining time series behavior except for the short time range between the aftermath of Asian financial crisis (1997) and the crush of dotcom boom (2001). Notice that, although a fluctuation in the central tendency of profit rates is definitely observable over the sample period, the amplitude of this oscillation is extremely small relative to the magnitude of the average movement expressed by the annual samples of logarithm of Tobin's qs. We emphasize this point due to the fact that the scale of y-axis on the left panel is *one order of magnitude smaller* than that on the right panel, which strongly sustains our claim that the range of fluctuation in central tendency for profit rates is very small relative to the counterpart of logarithm of Tobin's qs.

A comparison of volatilities between two corporate profitability measures reinforces our claim further. Given the one order of magnitude difference on the y-axis scale between middle left and right panels of Figure 4 as in the case of top panels, the scale parameter estimates for annual profit rate distributions exhibit extremely small magnitudes relative to the corresponding dispersion measures of logarithm of Tobin's qs.

More importantly, while the annual samples of logarithm of Tobin's qs are subject to unstable movement in skewness (asymmetry), time series pattern of the shape parameter associated with the profit rate samples provides good support for our central conjecture on the existence of an approximately stable distribution for this corporate profitability measure.

For the case of logarithm of Tobin's qs shown in bottom right panel of Figure 4, time series of the skewness statistics over the sample period suggests that the degree of asymmetry expressed in the annual empirical densities of this profitability measure is highly volatile (the skewness statistics varies from its minimum value = 0.343 to its maximum value = 1.792). We infer that this high volatility in skewness, together with the large magnitude of dispersion displayed in middle right panel of Figure 4, is a potential source for the inconsistent results returned from model selections under two information criteria between the pooled sample and annual samples of logarithm of Tobin's qs (see Tables 2, C3, and C4). These observations and associated inference force us to report that a unique and time-independent distribution reflecting the sample of logarithm of Tobin's qs is unavailable at this level of observation.

On the other hand, as shown in bottom left panel of Figure 4, time series of the shape parameter α corresponding to each annual profit rate sample exhibits oscillatory movement around the theoretical parameter value conforming to the Laplace hypothesis ($\hat{\alpha} = 1.0$) within a band of fluctuation with the lower bound $= 0.794$ (± 0.038) and the upper bound $= 1.339$ (± 0.074).[12] Note that there is no strong tendency for this parameter to move toward the Gaussian case ($\alpha = 2.0$) or the Walrasian equilibrium case ($\alpha = 0.0$). Given the relatively stable movement of the estimated shape parameter around the Laplace benchmark, together with the consistent results returned from model selections under AIC and BIC between the pooled sample and annual samples (see Tables 2, C1, and C2), we claim that, at the highest level of aggregation, the profit rate distribution is well described by the Laplace distribution and this result holds independently of time dimension in an approximate sense.

5 Sectoral disaggregation

Our main goal in this section is to check whether the empirical results obtained in the previous section still hold under the various levels of sample disaggregation. In particular, we focus on investigating whether there exists a stable distribution which captures the distributional properties of each profitability measure, *independent* of sectoral characteristics as well as of time dimension. To begin with, we classify the firm data into two classes - manufacturing and non-manufacturing sectors - and examine the properties of the profitability measures in question at the level of two sector disaggregation. After identifying the approximately time-invariant distributional properties of profitability measures under two sector decomposition, Subsection 5.2 provides our final analysis by investigating the distributional properties of two profitability measures at the level of each individual industry.

5.1 Two sector decomposition

Figure 5 displays pooled empirical densities (in the semi-log scale) of profit rates and logarithm of Tobin's qs for the group of long-lived Japanese firms in manufacturing and non-manufacturing sectors.

As shown in top panels of Figure 5, although a slight distortion is present in the left half of the empirical density for non-manufacturing sector, the Laplace distribution, on the whole, seems to be the best candidate in our candidate set for the profit rate distribution in each sector. We justify this simple speculation with the model selection results reported in Table 3. As shown in the table, the Laplace hypothesis for the profit rate distribution receives consistent support under two

[12] For the annual samples of profit rates, the estimated shape parameter is consistent with the Laplace distribution in 22 (52%) out of 42 years at the 95% confidence level.

information criteria, in each case of manufacturing and non-manufacturing sectors, which conforms to our observations in the previous section on the pooled sample of profit rates at the highest level of aggregation.

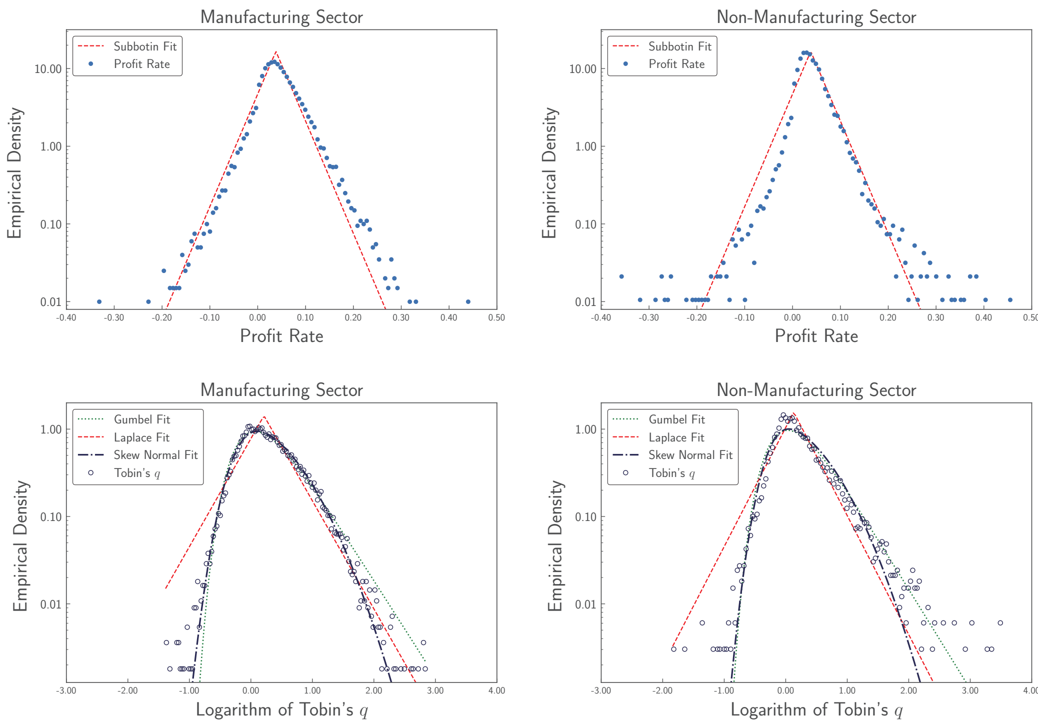

Figure 5: Pooled empirical densities of profit rates and logarithm of Tobin's qs for long-lived Japanese (non-financial) listed firms in manufacturing and non-manufacturing sectors. On the profit rates, 744 long-lived firms in manufacturing sector yield 31248 observations and 351 long-lived firms in non-manufacturing sector render 14742 observations over the 1971-2012 period. For Tobin's qs, the number of observations from the same class of firms in each sector over the 1983-2012 period is as follows: 19656 observations in manufacturing sector and 9268 observations in non-manufacturing sector. As in Figure 3, each panel shows the relevant theoretical distribution fit(s). Table 4 reports maximum likelihood parameter estimates for the distributions of profit rates and logarithm of Tobin's qs.

Parallel to our initial results for the potential properties of profit rate distribution, the adoption of two sector decomposition continues to reveal the distributional characteristics for logarithm of Tobin's qs, analogous to those of pooled sample observed in the previous section. As bottom panels of Figure 5 exhibit, the empirical density of this profitability measure in each sector is subject to the high degree of asymmetry with a long right tail, which suggests that selection of a potential candidate for the pooled sample of logarithm of Tobin's qs is restricted over a pair of Gumbel and skew normal distributions.[13] In accordance with the result for the pooled sample of logarithm of Tobin's qs in the previous section, Table 3 reports that, under two sector decomposition, AIC and BIC consistently select the skew normal distribution as the best approximating distribution for this profitability measure in each sector.

[13] In each case of manufacturing and non-manufacturing sectors, D'Agostino skewness test rejects the null hypothesis (p-value = 0.00), which suggests that the empirical density of logarithm of Tobin's qs in each sector is skewed relative to the Gaussian case.

AIC & BIC Statistics	Theoretical Distribution				Selection
	Gumbel	Laplace	Normal	Skew Normal	
		Manufacturing Sector			
AIC: Profit Rate	-84733.909	-107909.017	-103736.664	-104386.733	Laplace
BIC: Profit Rate	-84717.209	-107892.317	-103719.964	-104361.683	Laplace
AIC: Tobin's q	23703.723	25417.255	24679.403	23037.267	Skew Normal
BIC: Tobin's q	23719.495	25433.027	24695.175	23060.926	Skew Normal
		Non-Manufacturing Sector			
AIC: Profit Rate	-39379.150	-58233.843	-53918.906	-54374.297	Laplace
BIC: Profit Rate	-39363.953	-58218.646	-53903.710	-54351.502	Laplace
AIC: Tobin's q	10147.871	10196.889	11416.260	9809.220	Skew Normal
BIC: Tobin's q	10162.139	10211.157	11430.528	9830.623	Skew Normal

Table 3: Akaike information criterion (AIC) and Bayesian information criterion (BIC) statistics on the pooled samples of profit rates and logarithm of Tobin's qs for manufacturing and non-manufacturing sectors. Selection criterion for best approximating theoretical distribution is based on the lowest AIC and BIC scores.

With these initial observations under two sector classification, we report in Table 4 the maximum likelihood parameter estimates corresponding to the best approximating models for the pooled empirical densities of profit rates and logarithm of Tobin's qs in each sector. For the latter profitability measure, the table provides the information of parameter estimates corresponding to all theoretical distributions in our candidate set, for the sake of comparison.

As reported in the previous section, the benchmark central tendency and dispersion parameter values corresponding to the pooled sample of profit rates at the highest level of aggregation (Figure 3) return the location parameter $\hat{m} = 0.038$ (± 0.00016) and the scale parameter $\hat{\sigma} = 0.0306$ (± 0.00016), respectively, and the shape parameter consistent with the Laplace hypothesis is given by $\hat{\alpha} = 1.0$. Given these reference standards, a set of estimated values shown in top panel of Table 4 suggests that there is no dramatic deviation of the parameter estimates for the profit rate distribution in each sector from the corresponding benchmarks, and we emphasize that the estimated shape parameters for both sectors provide good support for the Laplace distribution as the best approximating model for the profit rate distribution under two sector decomposition.

For each sector, the pooled sample of logarithm of Tobin's qs returns the following statistics for central tendency: mean (manufacturing sector) = 0.280 (± 0.453), median (manufacturing sector) = 0.212; mean (non-manufacturing sector) = 0.226 (± 0.448), median (non-manufacturing sector) = 0.130. On the other hand, the corresponding statistics computed from the parameter values (shown in the last column of bottom panel of Table 4) associated with the skew normal distribution are as follows: mean (manufacturing sector) = 0.283 (± 0.450), median (manufacturing sector) = 0.230; mean (non-manufacturing sector) = 0.242 (± 0.430), median (non-manufacturing sector) = 0.185. Comparing these sample statistics with the counterparts based on the estimated parameter values for the best approximating model in the candidate set, together with our visual inspection of each empirical density shown in bottom panels of Figure 5, it is hard to reject that the skew normal distribution provides a reasonable fit for the pooled sample of logarithm of Tobin's qs in each sector.

Profit Rate				
	Subbotin Distribution			
Parameters	Manufacturing Sector		Non-Manufacturing Sector	
Location Parameter: m	0.0400 (0.0002)		0.0351 (0.0002)	
Scale Parameter: σ	0.0338 (0.0002)		0.0247 (0.0002)	
Shape Parameter: α	0.9280 (0.0122)		0.9280 (0.0122)	
Logarithm of Tobin's q				
	Theoretical Distribution			
Parameters	Gumbel	Laplace	Normal	Skew Normal
	Manufacturing Sector			
Location Parameter	0.069 (0.003)	0.212 (0.003)	0.280 (0.003)	-0.225 (0.005)
Scale Parameter	0.392 (0.002)	0.351 (0.003)	0.453 (0.002)	0.679 (0.005)
Shape Parameter	-	-	-	2.719 (0.061)
	Non-Manufacturing Sector			
Location Parameter	0.030 (0.004)	0.130 (0.004)	0.226 (0.005)	-0.259 (0.005)
Scale Parameter	0.380 (0.003)	0.319 (0.003)	0.448 (0.003)	0.660 (0.006)
Shape Parameter	-	-	-	3.089 (0.078)

Table 4: Maximum likelihood estimates of the parameters corresponding to candidate distributions for the pooled samples of profit rates and logarithm of Tobin's qs in manufacturing and non-manufacturing sectors. Standard errors are in parentheses. Shape parameters for the Gumbel, Laplace, and normal distributions are unavailable since each of these theoretical distributions is characterized as a two-parameter distribution.

To verify whether our findings obtained so far are sufficiently robust in view of the objective in this section, i.e., whether the best approximating distribution for the pooled sample of each profitability measure under two sector decomposition conforms to the one selected for each time-disaggregated sample, we check a series of model selection results for the annual samples of each measure.

As shown in Tables C5, C6, C7 and C8 in Appendix C, on the annual samples of profit rates, the model selection results under AIC and BIC *consistently* support the Laplace distribution as a good benchmark in both cases of manufacturing and non-manufacturing sectors. *At minimum*, these results confirm the Laplace hypothesis for both sectors in 39 (93%) out of 42 years of the entire sample period.

On the other hand, for the annual samples of logarithm of Tobin's qs, the model selections under two information criteria continue to render inconclusive results in both cases of manufacturing and non-manufacturing sectors. As with the case in the previous section, the results shown in Tables C9, C10, C11 and C12 are totally inconsistent with those reported in Table 3 for the pooled sample of logarithm of Tobin's qs in each sector, which suggests that there is no compelling support for selecting the skew normal or any other distribution as a benchmark for the case of logarithm of Tobin's qs.

While it seems that Figures B3, B4, B5, and B6 in Appendix B would provide the visual support for the Laplace hypothesis on annual profit rate densities and indicate unstable properties of the counterparts of logarithm of Tobin's qs under two sector decomposition, to check the credibility of our observations further, we examine the properties of maximum likelihood parameter estimates for the annual samples of profit rates and relevant statistics characterizing those of logarithm of Tobin's qs at this level of sample disaggregation. For the two sectors, the parameter estimates and relevant statistics are shown in Figures 6 (manufacturing sector) and 7 (non-manufacturing sector), each of which is an analogue of Figure 4 in Section 4. As reference standards, top through bottom left panels of both figures display the estimated values of location and scale parameters associated with the pooled sample of profit rates at the highest level of aggregation, and the shape parameter conforming to the Laplace hypothesis ($\hat{\alpha} = 1.0$), respectively.

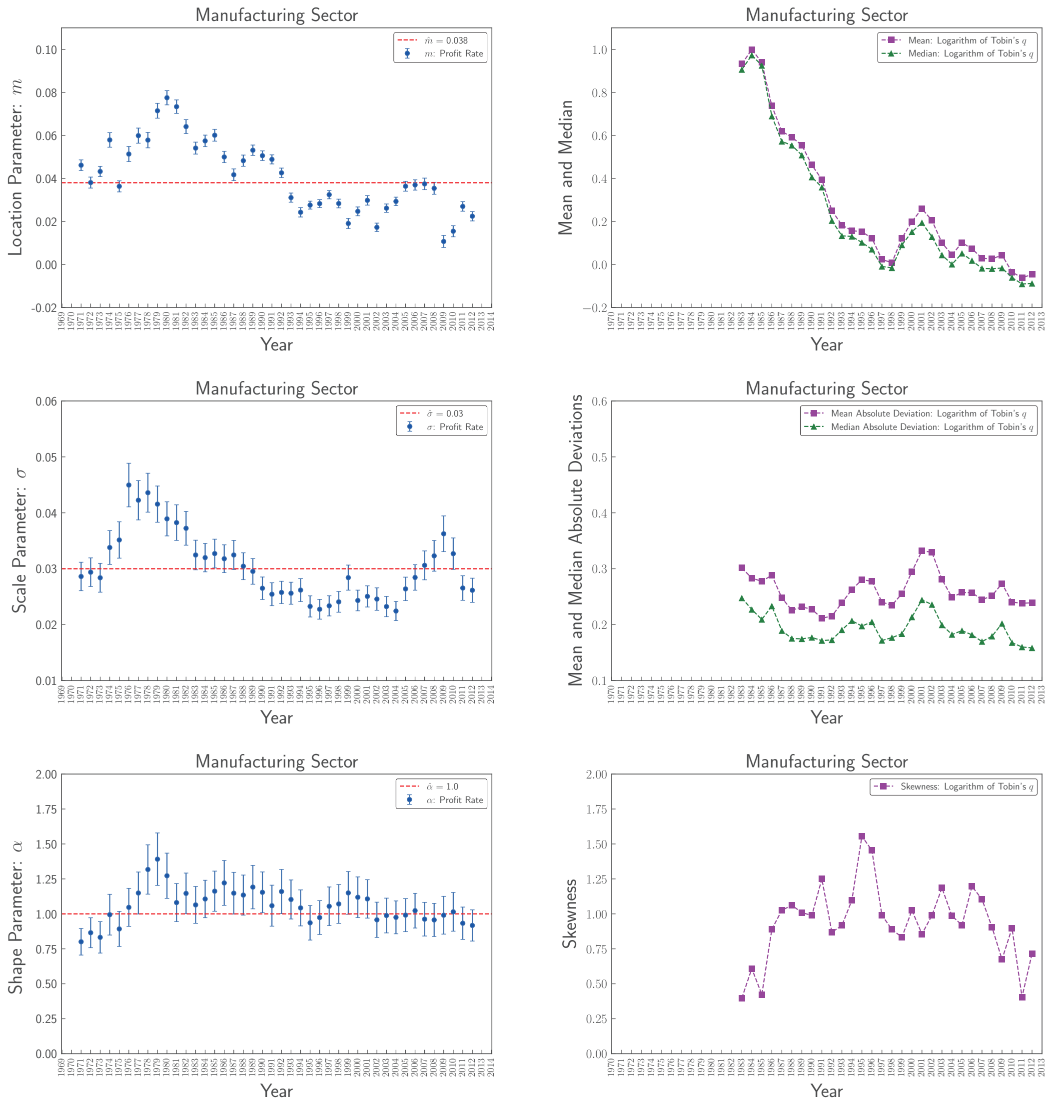

Figure 6: Year-by-year maximum likelihood estimates of the parameters corresponding to the Subbotin distribution for the annual samples of profit rates, and measures of central tendency, dispersion, and skewness for the annual samples of logarithm of Tobin's qs in manufacturing sectors. For the Subbotin parameter estimates of the profit rate densities, error bars display two standard errors.

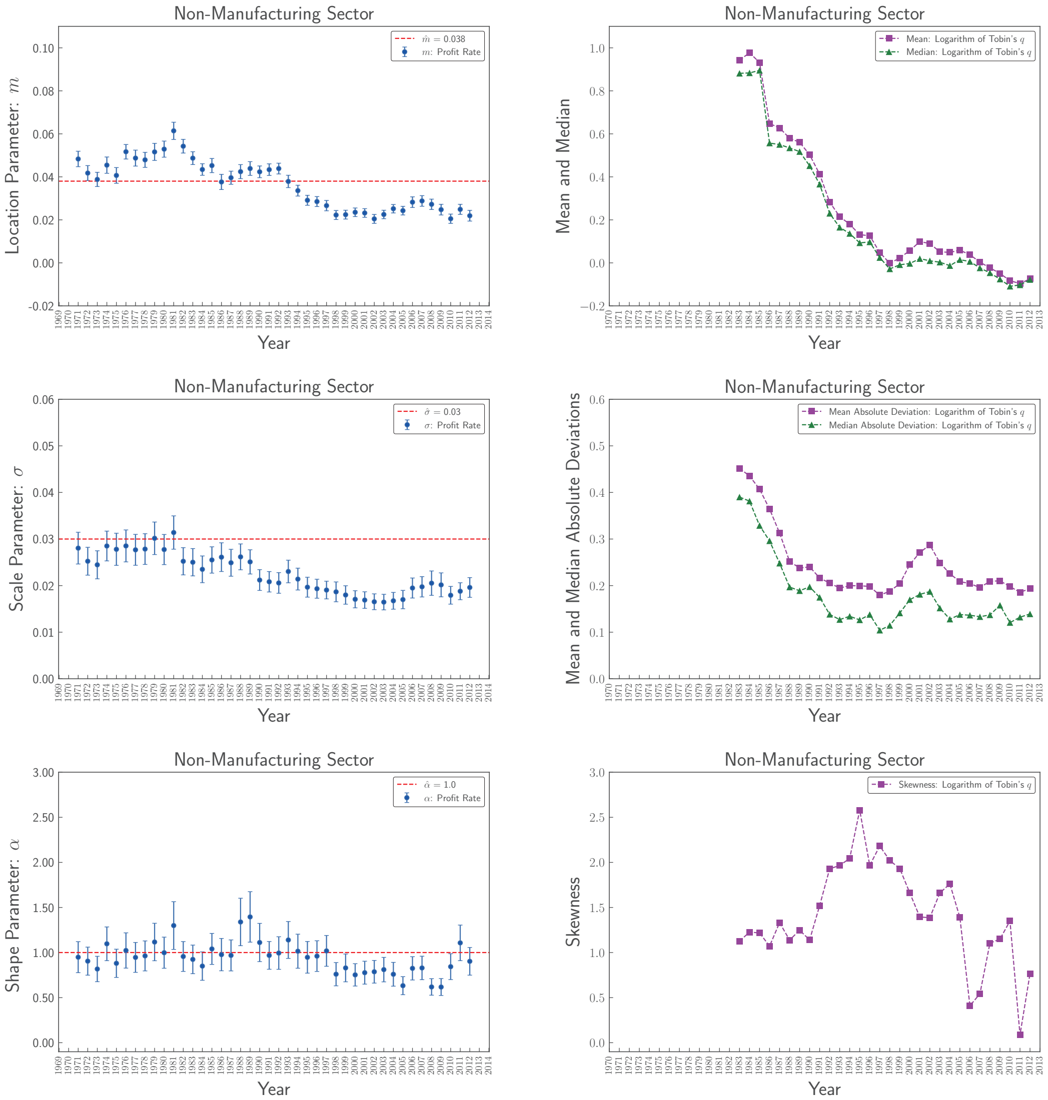

Figure 7: Year-by-year maximum likelihood estimates of the parameters corresponding to the Subbotin distribution for the annual samples of profit rates, and measures of central tendency, dispersion, and skewness for the annual samples of logarithm of Tobin's qs in non-manufacturing sectors. For the Subbotin parameter estimates of the profit rate densities, error bars display two standard errors.

As shown in top and middle panels of Figures 6 and 7, for both manufacturing and non-manufacturing sectors, each measure of central tendency and dispersion (location and scale parameters, respectively) for annual profit rate distributions shows very stable time series movement, relative to the corresponding statistics for those of logarithm of Tobin's qs. We continue to justify this observation by the fact that the scale of y-axis on top through middle left panels of Figures 6 and 7 is one order of magnitude smaller than that on the right hand side of the corresponding panels. In addition, time series behavior of shape parameter for the profit rate distribution in each sector (bottom left panels of Figures 6 and 7) strongly indicates that the Gaussian distribution ($\alpha = 2.0$) is not a pertinent model to capture the distributional properties of this profitability measure. As with the case under the highest level of aggregation that we discussed in the previous section, we observe the relatively stable movement of the estimated shape parameter for each sector around the benchmark value conforming to the Laplace hypothesis.[14]

On the other hand, the above observations under two sector decomposition do not show any powerful support for the presence of stable distribution (i.e., unique distribution independent of time and sectoral dimensions) for logarithm of Tobin's qs. In particular, as in the previous section, our model selection exercises render the inconsistent results between the pooled sample and annual samples for each case of manufacturing and non-manufacturing sectors. We suspect that the absence of stable distribution for logarithm of Tobin's qs may be ascribable to the rapidly changing skewness (asymmetry) of annual empirical densities in each sector. The time series behavior of skewness statistics shown in bottom right panels of Figures 6 and 7 illustrate this unstable distributional property of logarithm of Tobin's qs, common to both sectors.

5.2 Individual industries

In this subsection, we briefly discuss the empirical results obtained under the highest level of sample *disaggregation* in our analysis, i.e., the level of each individual industry. For the analysis at this individual sectoral level, we decided to omit the exercises of maximum likelihood parameter estimation for a pair of profitability measures, due to the very small number of annual samples in some industries[15] which would potentially render the highly spurious parameter estimates. Thus, our discussion in this subsection is strictly confined to a series of model selection results under two information criteria, for *pooled samples* of profit rates and logarithm of Tobin's qs in each individual industry. While Figures B7 and B8 in Appendix B display the pooled empirical densities of profit rates and logarithm of Tobin's qs for individual industries, Tables C13 through C16 in Appendix C report a series of model selection results corresponding to each industry.

Tables C13 and C14 show that, at minimum, in 24 (75%) out of 32 industries, the model selection results support the Laplace distribution as the best approximating model for pooled sample of profit rates.[16] Under two sector classification,

[14]For manufacturing sector, the estimated shape parameter α is consistent with the Laplace case in 28 (67%) out of 42 years at the 95% confidence level within a fluctuation band with $\alpha_{\min} = 0.801$ (± 0.048) and $\alpha_{\max} = 1.391$ (± 0.094). For non-manufacturing sector, the parameter estimate conforms to the Laplace case in 25 (60%) out of 42 years at the 95% confidence level within a fluctuation band with $\alpha_{\min} = 0.618$ (± 0.047) and $\alpha_{\max} = 1.395$ (± 0.139). As shown in bottom left panels of Figures 6 and 7, there is no strong tendency for α to move toward the Gaussian case ($\alpha = 2.0$) or Walrasian equilibrium case ($\alpha = 0.0$) in each sector.

[15]For example, as reported in Table A1 in Appendix A, we have only 2 annual observations (i.e., 2 surviving firms) in "Fish and Marine Products" industry (Nikkei Industry Code: MARIN) and only 4 annual observations (i.e., 4 surviving firms) in "Communication Services" industry (Nikkei Industry Code: COMM) for each individual year in the sample period.

[16]We are aware that, as discussed in Burnham and Anderson (2002), comparing the information criterion differences defined by $\Delta_i = IC_i - IC_{min}$, where i indexes candidate models, IC is the information criterion (AIC or BIC), and IC_{min} is the minimum information criterion score returned by a model in a candidate set, has the valuable information in model selection. We have checked the information criterion differences for each case in this study and comparisons for those differences do not require any substantial change in our argument for the results obtained from each model selection.

the results confirm the validity of the Laplace distribution, (at minimum) for 15 (88%) out of 17 manufacturing industries and 9 (60%) out of 15 non-manufacturing industries. On the other hand, as displayed in Tables C15 and C16, the model selections under AIC and BIC indicate that, (at minimum) in 21 (66%) out of 32 industries, the Gumbel distribution - not the skew normal distribution - would be a potential baseline distribution for pooled empirical densities of logarithm of Tobin's qs.

In sum, the model selection results under the individual industry level generally reaffirm our observations in the previous sections. The samples of logarithm of Tobin's qs at the individual sectoral level are subject to highly unstable distributional properties, as we discussed in the analysis at the higher levels of aggregation. On the contrary, while our analysis in this subsection is limited due to the absence of examination on time series behavior of maximum likelihood estimates for annual samples of profit rates at the individual industry level, the results obtained from model selections under two information criteria continue to provide good support for the Laplace distribution as a reasonable benchmark which captures the key distributional properties of the sample of profit rates for the group of long-lived firms.

6 Conclusion

In this paper, we have examined the distributional properties of two fundamental measures of corporate profitability - profit rate and Tobin's q - at the different levels of aggregation, for the case of Japan. One of our findings strongly suggests that, for the group of long-lived Japanese firms (excluding the firms operating in financial sector) over the 1971-2012 period, the empirical density of profit rates, measured by returns on assets, is well described by the Laplace distribution, the result of which is approximately independent of sectoral characteristics and time dimension. This finding provides robust support for one of the central predictions in statistical equilibrium approach to the theory of profit rate and firm competition, proposed by Alfarano et al. (2012): A stationary distribution for profit rates, arising from a complex competitive mechanism among profit-seeking firms, is well captured by the Laplace distribution (i.e., a special case of the Subbotin distribution). We hope that, along with the results reported in Erlingsson et al. (2012) and Mundt et al. (2015), our additional empirical support to this approach would spur a research topic of international comparison for the profit rate distribution in order to further investigate whether the key prediction in this approach holds in a global context.

On the other hand, this study casts a serious doubt on the existence of unique and stable distribution which reflects the key distributional properties of an alternative measure for firm profitability and performance - Tobin's q (in logarithmic scale). Our analysis reveals that the empirical density of Tobin's qs (in logarithmic scale) is subject to highly unstable properties, a potential cause of which lies in the precarious nature of the tail behavior associated with annual empirical densities of this profitability measure. In particular, our observation indicates that, after 1991, the annual density of Tobin's qs (in logarithmic scale) under (at least) the highest level of aggregation starts displaying a more leptokurtic shape than the skew normal distribution in our experimental candidate set. Given this conjecture, an interesting future research topic is to apply model selection approach to identifying the best approximating model for the empirical density of Tobin's qs (in logarithmic scale), by introducing an asymmetric exponential power distribution analyzed in Bottazzi and Secchi (2011) which incorporates, as a special case, an asymmetric Laplace distribution proposed in Scharfenaker and dos Santos (2015).

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Appendix A Industry characteristics

(A) Nikkei Industry Code	(B) Industry Name	(C) No. of All Firms	(D) No. of Long-Lived Firms	(D) / (C)
	Manufacturing Sector			
CGLAS	Stone, Clay and Glass Products	83	38	0.46
CHEM	Chemicals	228	112	0.49
DRUG	Drugs	73	23	0.32
EEQIP	Electric and Electronic Equipment	239	98	0.41
FOOD	Foods	166	68	0.41
IRON	Iron and Steel	74	44	0.59
MACH	Machinery	269	114	0.42
MOTOR	Motor Vehicles and Auto Parts	86	44	0.51
MTLPR	Non-Ferrous Metal and Metal Products	154	63	0.41
OTMFG	Other Manufactuirng	110	34	0.31
PAPER	Pulp and Paper	40	12	0.30
PETRO	Petroleum	18	7	0.39
PRCSN	Precision Equipment	57	20	0.35
RUBER	Rubber Products	23	13	0.57
SHPBLD	Shipbuilding and Repairing	12	6	0.50
TEXTL	Textile Products	82	41	0.50
TREQP	Transportation Equipment	25	7	0.28
	Non-Manufacturing Sector			
AIR	Air Transportation	7	5	0.71
COMM	Communication Services	37	4	0.11
CONST	Construction	221	91	0.41
EPOWR	Utilities - Electric	12	9	0.75
GAS	Utilities - Gas	13	7	0.54
MARIN	Fish and Marine Products	7	2	0.29
MING	Mining	16	5	0.31
RANDE	Real Estate	141	18	0.13
RETAL	Retail Trade	282	21	0.07
RL	Railroad Transportation	35	24	0.69
SEATR	Sea Transportation	26	12	0.46
SRVS	Services	772	34	0.04
TRADE	Wholesale Trade	368	79	0.21
TRK	Trucking	34	13	0.38
WRHSG	Warehousing and Harbor Transportation	45	27	0.60
Total	32 Industries	3755	1095	0.29

Table A1: Nikkei industry definitions and the number of firms in each industry for the 1971-2012 period.

Appendix B Empirical densities

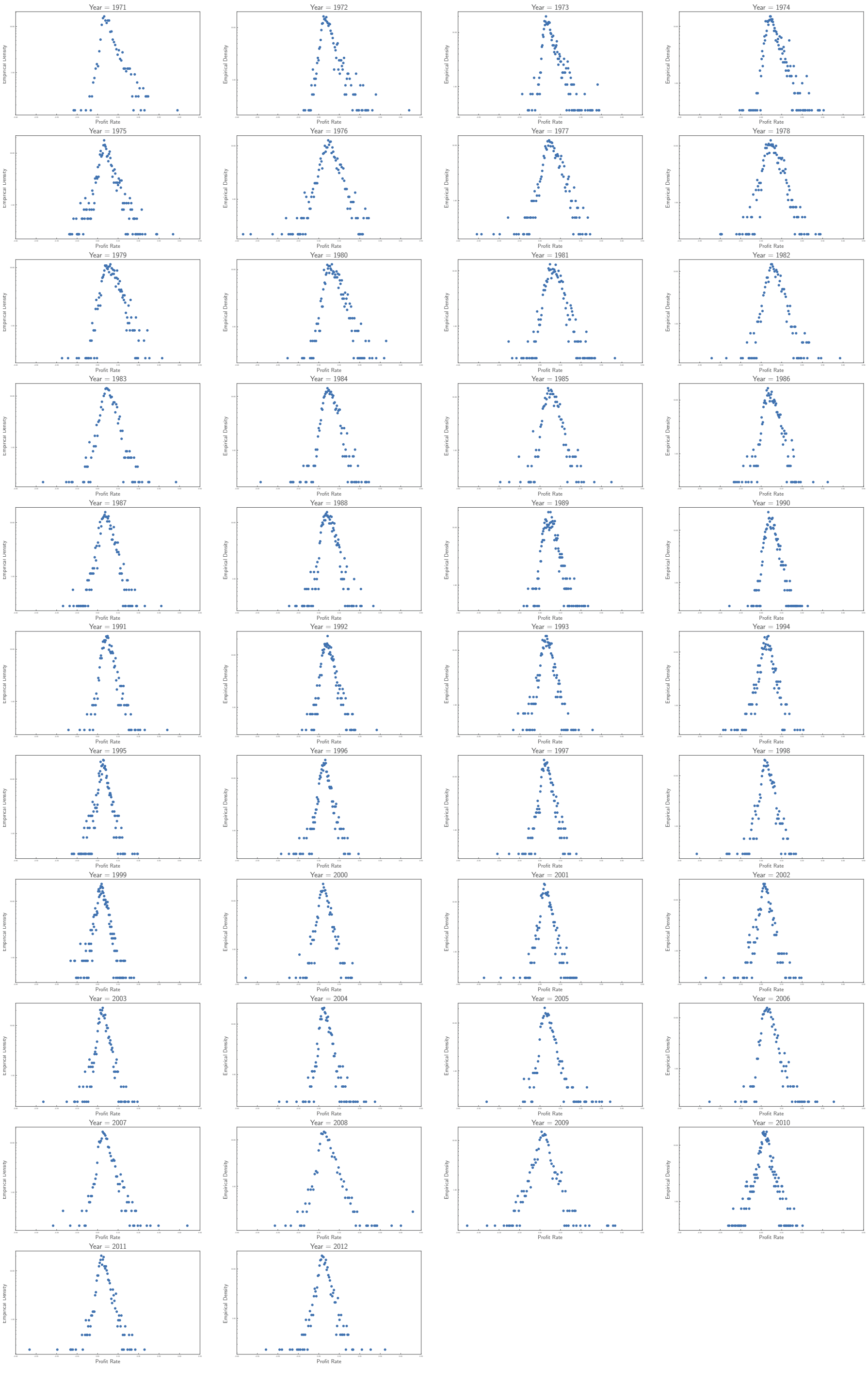

Figure B1: Year-by-year distribution of profit rates (returns on assets) for 1095 long-lived Japanese (non-financial) listed firms over the 1971-2012 period.

Figure B2: Year-by-year distribution of logarithm of Tobin's qs for 1095 long-lived Japanese (non-financial) listed firms over the 1983-2012 period. Tobin's q data is only available from 1983 due to the unavailability of market capitalization data up to 1982.

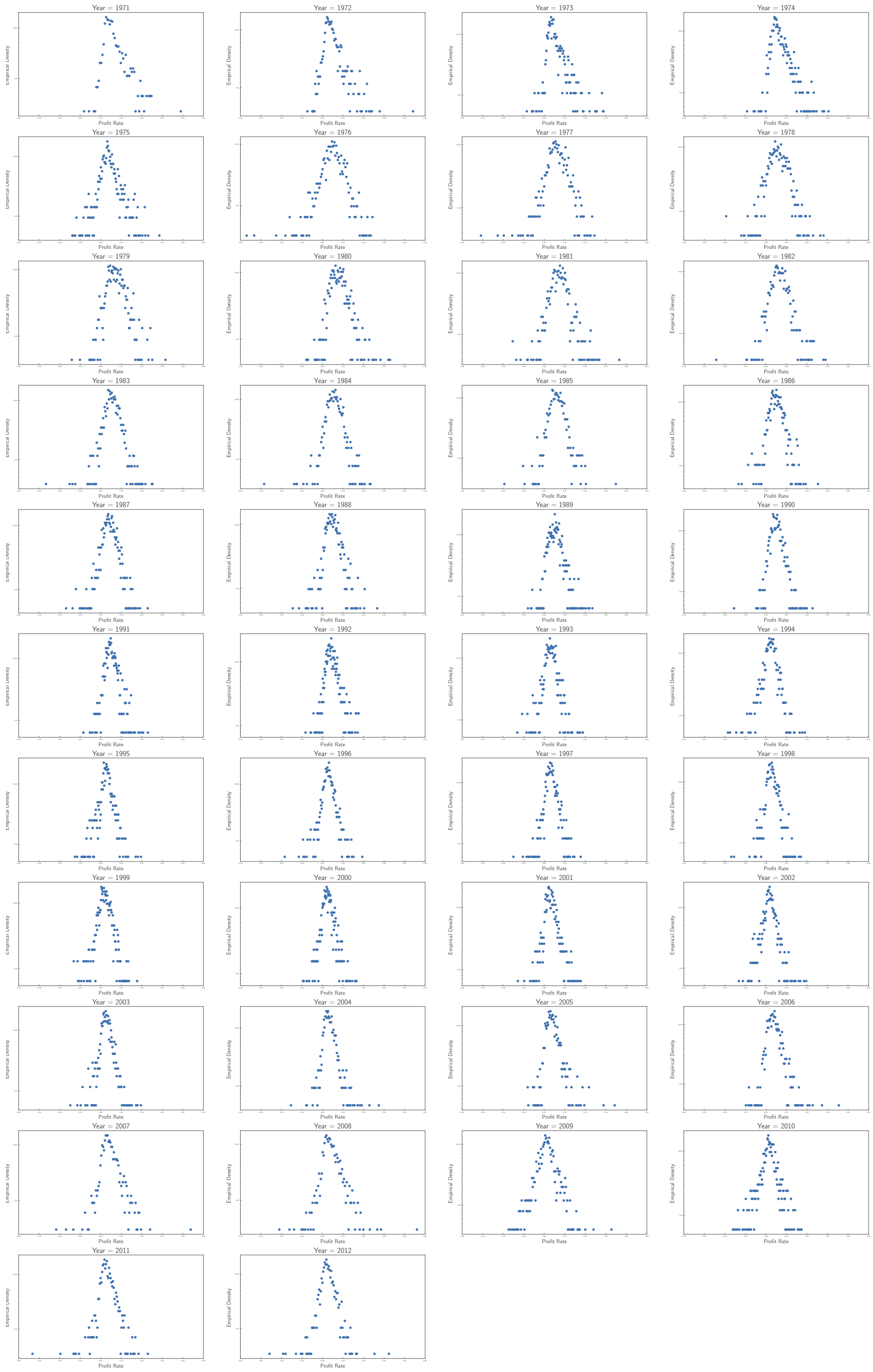

Figure B3: Year-by-year distribution of profit rates for 744 long-lived Japanese (non-financial) listed firms in manufacturing sector over the 1971-2012 period.

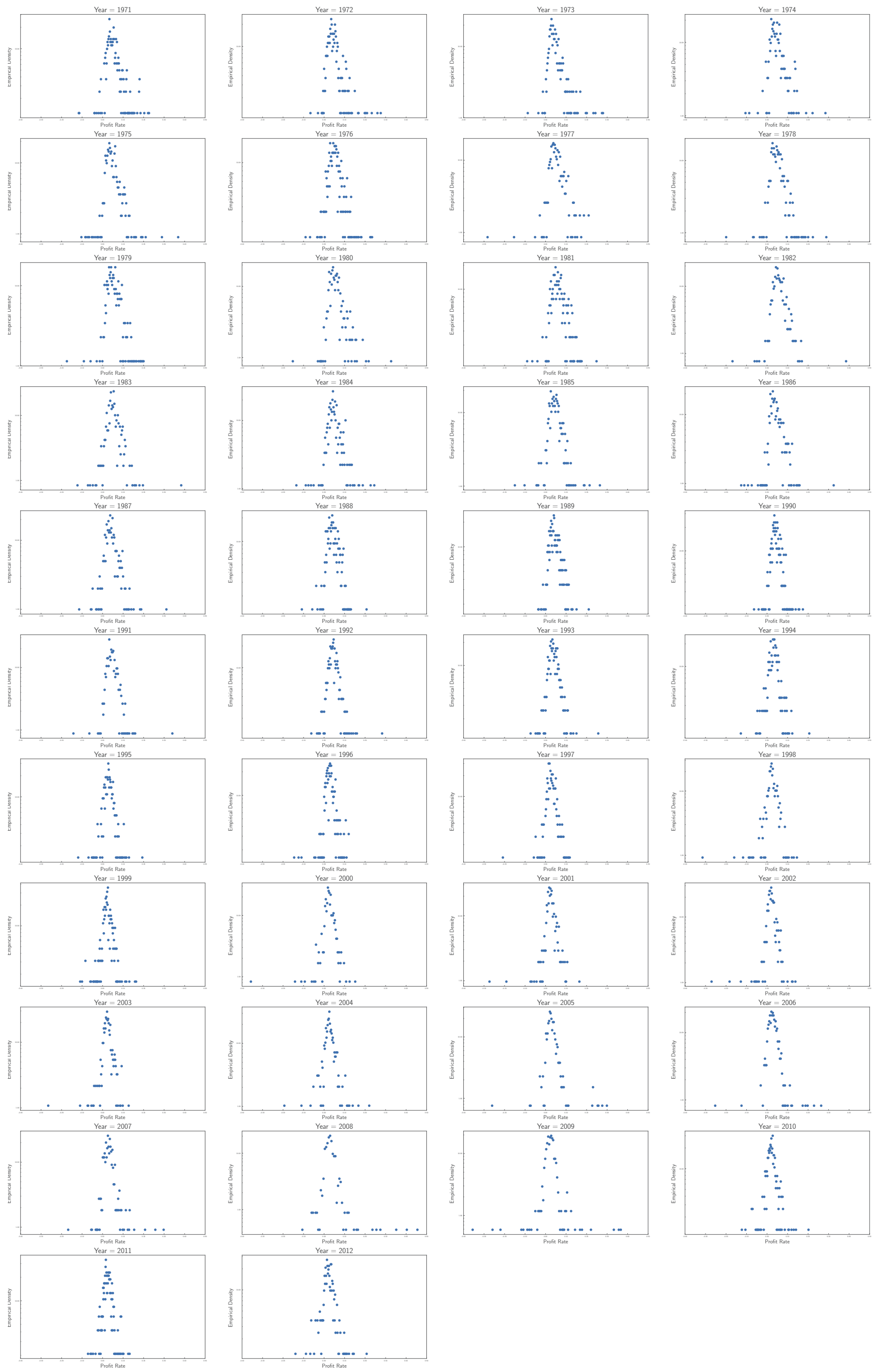

Figure B4: Year-by-year distribution of profit rates for 351 long-lived Japanese (non-financial) listed firms in non-manufacturing sector over the 1971-2012 period.

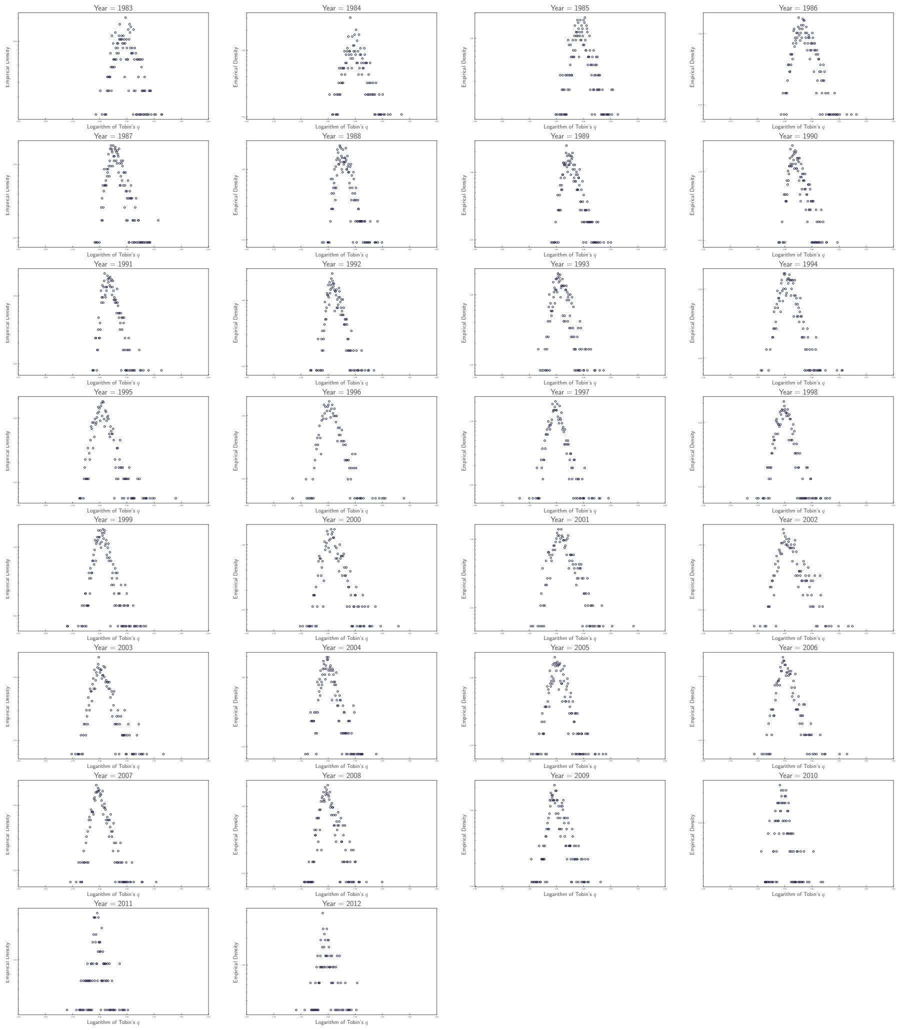

Figure B5: Year-by-year distribution of logarithm of Tobin's qs for 744 long-lived Japanese (non-financial) listed firms in manufacturing sector over the 1983-2012 period. Tobin's q data is only available from 1983 due to the unavailability of market capitalization data up to 1982.

Figure B6: Year-by-year distribution of logarithm of Tobin's qs for 351 long-lived Japanese (non-financial) listed firms in non-manufacturing sector over the 1983-2012 period. Tobin's q data is only available from 1983 due to the unavailability of market capitalization data up to 1982.

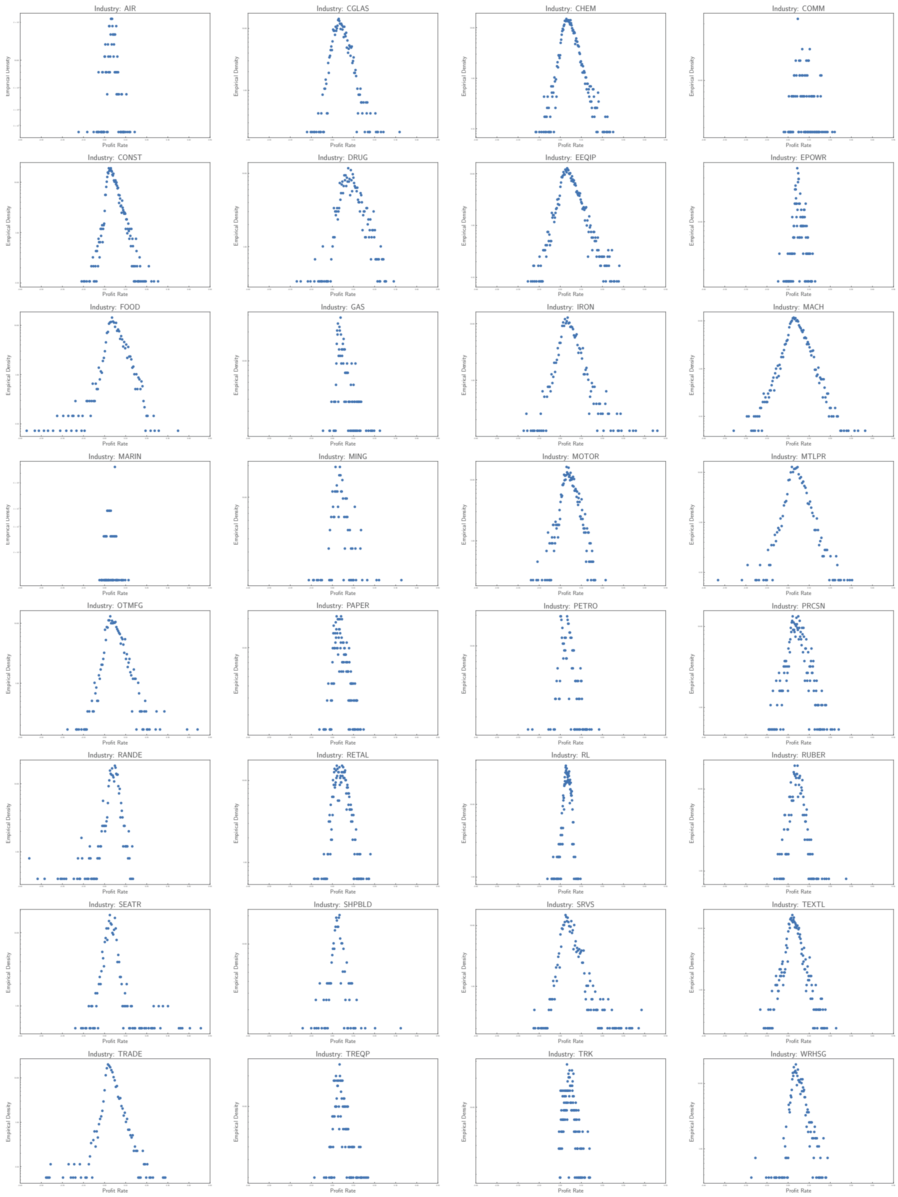

Figure B7: Distributions of profit rates for individual industries over the 1971-2012 period.

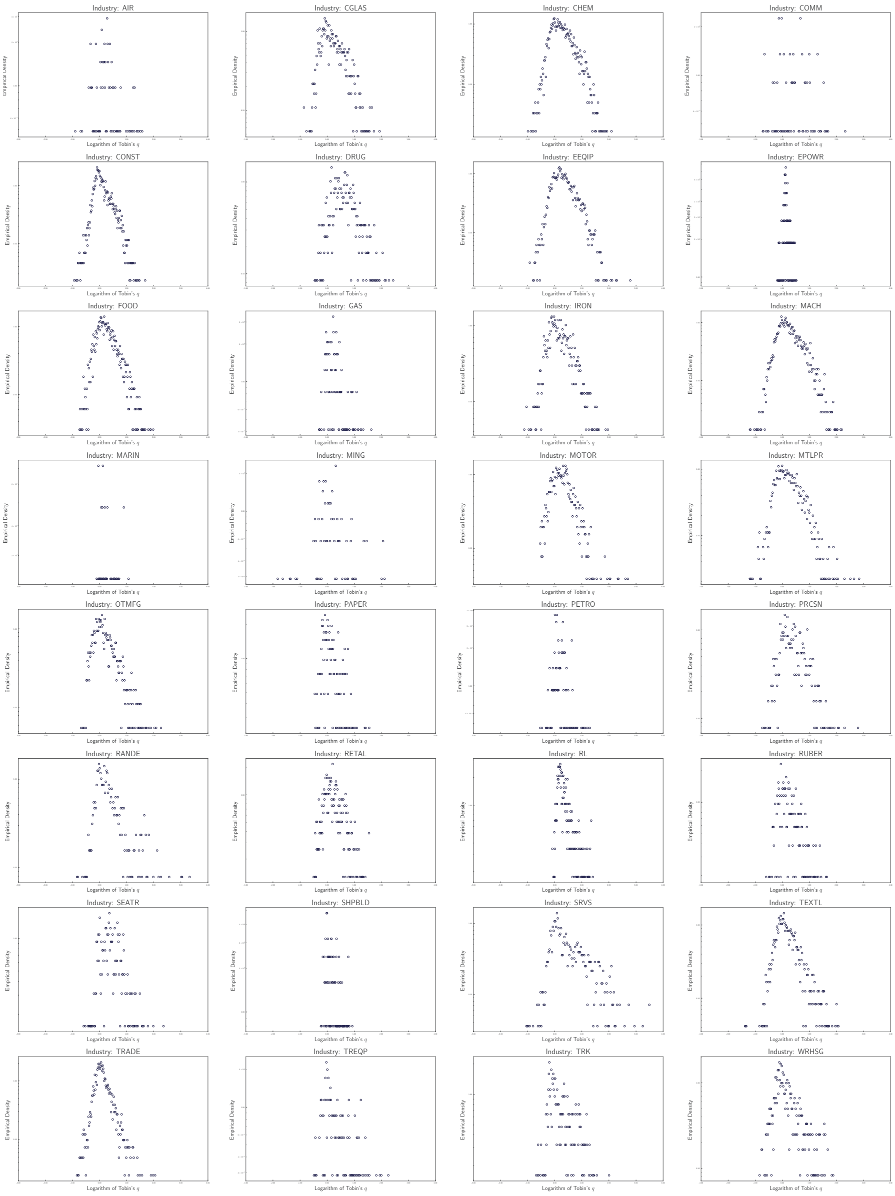

Figure B8: Distributions of logarithm of Tobin's qs for individual industries over the 1983-2012 period. Tobin's q data is only available from 1983 due to the unavailability of market capitalization data up to 1982.

Appendix C   Distribution selection

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	-2239.813	-3907.844	-3543.991	-3574.359	Laplace
1972	-3981.363	-3980.380	-3695.300	-3942.679	Gumbel
1973	-3931.611	-3992.739	-3720.336	-3955.742	Laplace
1974	-3716.357	-3805.177	-3642.140	-3807.435	Skew Normal
1975	-3235.078	-3652.619	-3426.173	-3460.895	Laplace
1976	-2381.559	-3390.776	-3184.905	-3212.759	Laplace
1977	-2601.721	-3537.533	-3370.793	-3390.112	Laplace
1978	-3038.971	-3567.329	-3470.336	-3474.182	Laplace
1979	-3313.585	-3623.415	-3592.777	-3619.456	Laplace
1980	-3461.500	-3665.345	-3591.115	-3664.388	Laplace
1981	-3211.608	-3647.377	-3523.641	-3546.709	Laplace
1982	-3124.186	-3798.614	-3625.535	-3653.938	Laplace
1983	-3101.534	-3976.605	-3759.597	-3768.450	Laplace
1984	-3051.013	-4010.125	-3836.096	-3835.014	Laplace
1985	-3393.168	-3997.816	-3857.576	-3870.921	Laplace
1986	-3616.919	-4055.429	-3950.958	-3964.414	Laplace
1987	-3486.779	-4043.117	-3892.412	-3896.210	Laplace
1988	-3715.838	-4170.486	-4063.251	-4076.180	Laplace
1989	-4129.249	-4261.485	-4197.938	-4259.720	Laplace
1990	-3989.964	-4476.778	-4364.313	-4410.498	Laplace
1991	-4011.068	-4479.341	-4285.304	-4354.504	Laplace
1992	-4309.954	-4536.611	-4403.722	-4465.196	Laplace
1993	-3954.324	-4465.012	-4323.573	-4328.632	Laplace
1994	-3611.628	-4400.114	-4218.730	-4233.422	Laplace
1995	-3948.019	-4574.226	-4363.201	-4362.103	Laplace
1996	-3772.538	-4651.908	-4424.379	-4436.434	Laplace
1997	-3745.113	-4673.880	-4497.764	-4504.999	Laplace
1998	-3159.936	-4560.909	-4290.444	-4323.406	Laplace
1999	-3837.352	-4400.468	-4241.266	-4239.239	Laplace
2000	-3018.953	-4636.487	-4354.312	-4379.262	Laplace
2001	-3367.190	-4590.188	-4333.553	-4331.410	Laplace
2002	-3401.543	-4547.316	-4251.897	-4249.897	Laplace
2003	-3460.048	-4669.430	-4390.416	-4400.637	Laplace
2004	-3818.273	-4682.899	-4369.829	-4419.005	Laplace
2005	-3396.664	-4340.267	-3931.344	-4057.310	Laplace
2006	-3404.299	-4255.538	-3956.732	-4033.770	Laplace
2007	-3381.421	-4094.940	-3775.630	-3848.247	Laplace
2008	-2240.033	-3872.296	-3364.391	-3413.962	Laplace
2009	-2719.619	-3706.375	-3341.889	-3355.109	Laplace
2010	-3453.719	-4086.980	-3866.789	-3875.201	Laplace
2011	-3051.286	-4419.663	-4129.674	-4139.979	Laplace
2012	-3337.605	-4363.282	-4047.060	-4055.299	Laplace

Table C1: Akaike information criterion (AIC) statistics for the annual samples of profit rates (returns on assets). Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. As the last column shows, in 40 out of 42 years (95%), AIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

Year	Theoretical Distribution				Selection
	Gumbel	Laplace	Normal	Skew Normal	
1971	-2229.816	-3897.847	-3533.994	-3559.363	Laplace
1972	-3971.366	-3970.383	-3685.303	-3927.683	Gumbel
1973	-3921.614	-3982.742	-3710.339	-3940.746	Laplace
1974	-3706.360	-3795.180	-3632.143	-3792.440	Laplace
1975	-3225.081	-3642.622	-3416.176	-3445.899	Laplace
1976	-2371.562	-3380.779	-3174.908	-3197.764	Laplace
1977	-2591.724	-3527.536	-3360.796	-3375.117	Laplace
1978	-3028.974	-3557.332	-3460.339	-3459.186	Laplace
1979	-3303.588	-3613.418	-3582.780	-3604.460	Laplace
1980	-3451.503	-3655.348	-3581.118	-3649.393	Laplace
1981	-3201.611	-3637.380	-3513.644	-3531.714	Laplace
1982	-3114.189	-3788.617	-3615.538	-3638.943	Laplace
1983	-3091.537	-3966.608	-3749.600	-3753.455	Laplace
1984	-3041.016	-4000.128	-3826.099	-3820.018	Laplace
1985	-3383.171	-3987.819	-3847.579	-3855.925	Laplace
1986	-3606.922	-4045.432	-3940.961	-3949.418	Laplace
1987	-3476.782	-4033.120	-3882.415	-3881.215	Laplace
1988	-3705.841	-4160.489	-4053.254	-4061.185	Laplace
1989	-4119.252	-4251.488	-4187.941	-4244.725	Laplace
1990	-3979.967	-4466.781	-4354.316	-4395.503	Laplace
1991	-4001.071	-4469.344	-4275.307	-4339.508	Laplace
1992	-4299.957	-4526.614	-4393.725	-4450.200	Laplace
1993	-3944.327	-4455.015	-4313.576	-4313.636	Laplace
1994	-3601.631	-4390.117	-4208.733	-4218.426	Laplace
1995	-3938.022	-4564.229	-4353.204	-4347.107	Laplace
1996	-3762.541	-4641.911	-4414.382	-4421.438	Laplace
1997	-3735.116	-4663.883	-4487.767	-4490.004	Laplace
1998	-3149.939	-4550.912	-4280.447	-4308.411	Laplace
1999	-3827.355	-4390.471	-4231.269	-4224.243	Laplace
2000	-3008.956	-4626.490	-4344.315	-4364.267	Laplace
2001	-3357.193	-4580.191	-4323.556	-4316.415	Laplace
2002	-3391.546	-4537.319	-4241.900	-4234.901	Laplace
2003	-3450.051	-4659.433	-4380.419	-4385.641	Laplace
2004	-3808.276	-4672.902	-4359.832	-4404.010	Laplace
2005	-3386.667	-4330.270	-3921.347	-4042.315	Laplace
2006	-3394.302	-4245.541	-3946.734	-4018.774	Laplace
2007	-3371.424	-4084.943	-3765.633	-3833.251	Laplace
2008	-2230.036	-3862.299	-3354.394	-3398.967	Laplace
2009	-2709.621	-3696.377	-3331.892	-3340.113	Laplace
2010	-3443.722	-4076.983	-3856.792	-3860.205	Laplace
2011	-3041.289	-4409.666	-4119.677	-4124.983	Laplace
2012	-3327.608	-4353.285	-4037.063	-4040.304	Laplace

Table C2: Bayesian information criterion (BIC) statistics for the annual samples of profit rates (returns on assets). Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. As the last column shows, in 41 out of 42 years (98%), BIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

Year	Theoretical Distribution				Selection
	Gumbel	Laplace	Normal	Skew Normal	
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	774.356	841.261	816.091	767.434	Skew Normal
1984	747.454	782.823	801.234	744.747	Skew Normal
1985	787.349	783.667	807.440	765.577	Skew Normal
1986	989.167	1142.729	1123.731	996.180	Gumbel
1987	643.535	792.040	839.442	664.730	Gumbel
1988	372.720	506.407	530.749	383.555	Gumbel
1989	369.171	495.897	526.982	377.958	Gumbel
1990	301.648	473.460	469.734	306.233	Gumbel
1991	183.575	297.598	362.955	205.871	Gumbel
1992	299.678	278.835	366.483	248.237	Skew Normal
1993	420.741	410.266	509.834	395.595	Skew Normal
1994	634.191	588.069	729.451	612.301	Laplace
1995	695.263	673.494	938.207	741.478	Laplace
1996	798.303	668.175	868.715	732.447	Laplace
1997	636.328	389.031	592.434	499.799	Laplace
1998	635.497	375.536	573.159	486.475	Laplace
1999	725.227	591.221	733.748	626.911	Laplace
2000	935.314	932.042	1051.096	921.334	Skew Normal
2001	1097.324	1172.253	1208.173	1088.826	Skew Normal
2002	1127.295	1151.222	1235.198	1102.392	Skew Normal
2003	939.311	811.115	1012.560	878.333	Laplace
2004	633.527	547.377	723.422	591.082	Laplace
2005	725.636	566.328	695.643	600.668	Laplace
2006	925.826	545.280	698.163	618.224	Laplace
2007	761.330	441.319	603.787	528.890	Laplace
2008	632.713	510.890	642.978	564.069	Laplace
2009	568.467	482.257	561.581	509.329	Laplace
2010	253.634	169.250	258.487	224.270	Laplace
2011	256.556	124.349	177.963	173.340	Laplace
2012	217.933	130.039	184.397	165.499	Laplace

Table C3: Akaike information criterion (AIC) statistics for the annual samples of logarithm of Tobin's qs. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. Frequencies of selected distributions in the last column (in descending order) are as follows. Laplace distribution: 16, Skew normal distribution: 8, Gumbel distribution: 6, Normal distribution: 0. These results suggest that distributional properties of logarithm of Tobin's qs are highly unstable.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	2172.849	2338.026	2810.070	2325.833	Gumbel
1984	2264.684	2407.726	2999.843	2471.761	Gumbel
1985	2266.000	2402.487	3086.455	2533.133	Gumbel
1986	2712.511	2967.661	3466.743	2785.490	Gumbel
1987	2190.139	2431.697	3030.047	2337.545	Gumbel
1988	1766.518	2006.069	2439.736	1875.836	Gumbel
1989	1692.945	1928.728	2372.139	1809.359	Gumbel
1990	1457.545	1715.951	2110.911	1543.078	Gumbel
1991	1174.116	1394.488	2030.624	1392.949	Gumbel
1992	880.861	1069.300	1695.960	1119.995	Gumbel
1993	896.625	1072.720	1732.574	1141.052	Gumbel
1994	1085.972	1245.799	2112.831	1416.140	Gumbel
1995	1310.108	1450.209	2768.156	1842.195	Gumbel
1996	1179.517	1331.066	2602.658	1729.050	Gumbel
1997	639.263	733.552	1625.816	989.059	Gumbel
1998	558.881	650.533	1482.212	879.015	Gumbel
1999	915.249	1069.820	1758.308	1156.087	Gumbel
2000	1440.022	1627.019	2491.469	1740.325	Gumbel
2001	1748.890	1977.655	2783.740	2009.907	Gumbel
2002	1694.396	1906.528	2709.777	1947.356	Gumbel
2003	1241.037	1388.480	2352.008	1593.844	Gumbel
2004	806.727	950.569	1686.594	1056.447	Gumbel
2005	867.849	1020.866	1671.804	1097.049	Gumbel
2006	817.793	956.620	1792.109	1143.997	Gumbel
2007	624.734	735.553	1458.212	893.130	Gumbel
2008	654.414	772.714	1394.718	873.271	Gumbel
2009	577.947	683.350	1072.437	708.048	Gumbel
2010	201.191	231.100	526.326	310.719	Gumbel
2011	116.116	120.924	259.795	158.116	Gumbel
2012	134.406	161.865	333.331	192.809	Gumbel

Table C4: Bayesian information criterion (BIC) statistics for the annual samples of logarithm of Tobin's qs. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. The last column shows that, for each annual sample in the entire sample period (1983-2012), BIC statistics support the Gumbel distribution as the best approximating model. The sharp difference in the model selection results between AIC and BIC seems to stem from the absence of penalty term on the sample size in AIC approach. Note, however, that the model selection results for annual samples under BIC approach are inconsistent with the result (the skew normal distribution) for the pooled sample of logarithm of Tobin's qs (reported in Table 2), which leaves the presence of unique and stable distribution for this alternative profitability measure highly obscure.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	-1424.218	-2606.662	-2325.456	-2339.165	Laplace
1972	-2639.697	-2627.595	-2438.041	-2606.843	Gumbel
1973	-2618.948	-2650.759	-2489.374	-2632.804	Laplace
1974	-2515.888	-2513.347	-2423.794	-2549.411	Skew Normal
1975	-2120.559	-2383.588	-2259.948	-2272.742	Laplace
1976	-1493.003	-2120.275	-2007.794	-2035.907	Laplace
1977	-1718.156	-2267.125	-2188.630	-2203.771	Laplace
1978	-1994.763	-2291.383	-2265.705	-2263.793	Laplace
1979	-2247.758	-2388.856	-2380.921	-2395.120	Skew Normal
1980	-2355.484	-2441.680	-2401.619	-2438.396	Laplace
1981	-2059.868	-2380.027	-2278.131	-2288.557	Laplace
1982	-2039.326	-2453.311	-2372.754	-2383.657	Laplace
1983	-2011.162	-2615.061	-2496.719	-2499.767	Laplace
1984	-1978.571	-2659.163	-2548.376	-2546.376	Laplace
1985	-2242.509	-2653.193	-2570.151	-2573.638	Laplace
1986	-2439.472	-2722.754	-2671.254	-2673.280	Laplace
1987	-2282.875	-2658.543	-2584.987	-2588.439	Laplace
1988	-2431.631	-2746.669	-2662.531	-2669.131	Laplace
1989	-2695.000	-2819.617	-2760.276	-2794.328	Laplace
1990	-2614.674	-2962.404	-2885.223	-2911.096	Laplace
1991	-2824.654	-2974.232	-2888.296	-2929.667	Laplace
1992	-2875.576	-3007.940	-2947.606	-2981.312	Laplace
1993	-2625.827	-2987.999	-2896.776	-2895.447	Laplace
1994	-2389.765	-2922.699	-2801.115	-2813.365	Laplace
1995	-2627.666	-3029.740	-2896.200	-2894.196	Laplace
1996	-2535.757	-3088.392	-2944.291	-2948.624	Laplace
1997	-2674.154	-3098.466	-2999.247	-2997.826	Laplace
1998	-2579.185	-3063.161	-2962.337	-2961.752	Laplace
1999	-2541.496	-2857.748	-2790.316	-2788.316	Laplace
2000	-2848.818	-3073.354	-2995.827	-3010.456	Laplace
2001	-2757.842	-3023.261	-2933.517	-2953.972	Laplace
2002	-2661.963	-2962.847	-2835.134	-2843.146	Laplace
2003	-2654.426	-3066.891	-2930.562	-2936.291	Laplace
2004	-2736.097	-3110.394	-2943.365	-2997.175	Laplace
2005	-2757.420	-2879.081	-2714.379	-2804.881	Laplace
2006	-2636.172	-2787.600	-2647.660	-2716.608	Laplace
2007	-2201.881	-2639.668	-2475.918	-2509.023	Laplace
2008	-2179.058	-2555.676	-2385.446	-2423.813	Laplace
2009	-2136.353	-2406.557	-2297.690	-2303.944	Laplace
2010	-2237.213	-2575.455	-2480.120	-2484.054	Laplace
2011	-1947.887	-2830.761	-2643.347	-2654.410	Laplace
2012	-2165.146	-2841.950	-2641.976	-2645.039	Laplace

Table C5: Akaike information criterion (AIC) statistics for the annual samples of profit rates (returns on assets) in manufacturing sector. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. As the last column shows, in 39 out of 42 years (93%), AIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	-1414.994	-2597.438	-2316.232	-2325.329	Laplace
1972	-2630.473	-2618.371	-2428.817	-2593.007	Gumbel
1973	-2609.724	-2641.534	-2480.150	-2618.968	Laplace
1974	-2506.664	-2504.123	-2414.570	-2535.574	Skew Normal
1975	-2111.335	-2374.364	-2250.724	-2258.906	Laplace
1976	-1483.779	-2111.051	-1998.570	-2022.071	Laplace
1977	-1708.932	-2257.901	-2179.406	-2189.935	Laplace
1978	-1985.539	-2282.159	-2256.481	-2249.957	Laplace
1979	-2238.534	-2379.632	-2371.697	-2381.284	Skew Normal
1980	-2346.260	-2432.456	-2392.395	-2424.560	Laplace
1981	-2050.644	-2370.803	-2268.907	-2274.720	Laplace
1982	-2030.102	-2444.087	-2363.530	-2369.821	Laplace
1983	-2001.937	-2605.837	-2487.495	-2485.930	Laplace
1984	-1969.347	-2649.939	-2539.152	-2532.540	Laplace
1985	-2233.285	-2643.969	-2560.927	-2559.802	Laplace
1986	-2430.248	-2713.530	-2662.030	-2659.444	Laplace
1987	-2273.651	-2649.318	-2575.763	-2574.603	Laplace
1988	-2422.407	-2737.445	-2653.307	-2655.295	Laplace
1989	-2685.776	-2810.393	-2751.052	-2780.492	Laplace
1990	-2605.450	-2953.180	-2875.999	-2897.260	Laplace
1991	-2815.430	-2965.008	-2879.072	-2915.830	Laplace
1992	-2866.352	-2998.716	-2938.382	-2967.476	Laplace
1993	-2616.603	-2978.775	-2887.552	-2881.611	Laplace
1994	-2380.541	-2913.475	-2791.891	-2799.529	Laplace
1995	-2618.442	-3020.516	-2886.975	-2880.360	Laplace
1996	-2526.533	-3079.168	-2935.067	-2934.788	Laplace
1997	-2664.930	-3089.242	-2990.023	-2983.990	Laplace
1998	-2569.961	-3053.937	-2953.113	-2947.916	Laplace
1999	-2532.272	-2848.524	-2781.092	-2774.480	Laplace
2000	-2839.594	-3064.129	-2986.603	-2996.620	Laplace
2001	-2748.618	-3014.037	-2924.293	-2940.136	Laplace
2002	-2652.739	-2953.623	-2825.910	-2829.310	Laplace
2003	-2645.202	-3057.667	-2921.337	-2922.455	Laplace
2004	-2726.873	-3101.170	-2934.141	-2983.339	Laplace
2005	-2748.196	-2869.857	-2705.155	-2791.045	Laplace
2006	-2626.948	-2778.375	-2638.436	-2702.772	Laplace
2007	-2192.657	-2630.444	-2466.694	-2495.187	Laplace
2008	-2169.834	-2546.452	-2376.222	-2409.977	Laplace
2009	-2127.129	-2397.333	-2288.466	-2290.108	Laplace
2010	-2227.989	-2566.231	-2470.896	-2470.218	Laplace
2011	-1938.663	-2821.537	-2634.123	-2640.574	Laplace
2012	-2155.922	-2832.726	-2632.752	-2631.203	Laplace

Table C6: Bayesian information criterion (BIC) statistics for the annual samples of profit rates (returns on assets) in manufacturing sector. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. As the last column shows, in 39 out of 42 years (93%), BIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	-1160.759	-1300.252	-1232.126	-1254.136	Laplace
1972	-1356.289	-1359.462	-1266.785	-1350.872	Laplace
1973	-1312.883	-1346.049	-1234.142	-1324.838	Laplace
1974	-1238.991	-1331.092	-1277.580	-1308.923	Laplace
1975	-1164.543	-1282.611	-1179.024	-1213.619	Laplace
1976	-1234.007	-1311.232	-1259.811	-1283.100	Laplace
1977	-881.885	-1308.434	-1212.837	-1217.495	Laplace
1978	-1046.075	-1309.903	-1227.246	-1239.444	Laplace
1979	-1083.516	-1296.518	-1255.339	-1259.289	Laplace
1980	-1143.651	-1323.328	-1249.149	-1277.784	Laplace
1981	-1229.271	-1306.621	-1294.384	-1304.955	Laplace
1982	-1111.228	-1377.140	-1279.749	-1294.717	Laplace
1983	-1198.474	-1372.068	-1269.771	-1291.394	Laplace
1984	-1176.610	-1389.589	-1303.185	-1312.504	Laplace
1985	-1165.244	-1394.492	-1320.364	-1328.001	Laplace
1986	-1177.388	-1359.569	-1284.958	-1295.842	Laplace
1987	-1253.805	-1389.953	-1311.924	-1332.972	Laplace
1988	-1311.326	-1441.282	-1430.347	-1432.119	Laplace
1989	-1479.588	-1481.077	-1476.539	-1498.787	Skew Normal
1990	-1455.902	-1542.863	-1505.396	-1520.346	Laplace
1991	-1246.305	-1515.555	-1402.055	-1426.249	Laplace
1992	-1442.314	-1532.248	-1456.674	-1485.237	Laplace
1993	-1403.506	-1490.958	-1445.795	-1461.327	Laplace
1994	-1298.377	-1510.404	-1451.247	-1451.528	Laplace
1995	-1334.097	-1549.060	-1477.611	-1479.085	Laplace
1996	-1235.124	-1565.325	-1485.103	-1492.386	Laplace
1997	-1146.437	-1593.331	-1511.032	-1522.477	Laplace
1998	-899.328	-1507.989	-1338.210	-1385.280	Laplace
1999	-1318.657	-1567.844	-1472.441	-1471.192	Laplace
2000	-837.383	-1565.729	-1359.179	-1417.495	Laplace
2001	-972.253	-1586.061	-1409.809	-1445.175	Laplace
2002	-986.829	-1605.536	-1420.598	-1462.316	Laplace
2003	-1020.251	-1620.304	-1468.731	-1503.976	Laplace
2004	-1160.548	-1584.686	-1434.589	-1435.535	Laplace
2005	-990.705	-1491.792	-1225.788	-1264.804	Laplace
2006	-1014.763	-1506.928	-1327.124	-1336.454	Laplace
2007	-1210.884	-1499.889	-1339.966	-1378.297	Laplace
2008	-595.041	-1336.011	-997.128	-1011.103	Laplace
2009	-765.495	-1352.317	-1055.150	-1061.649	Laplace
2010	-1308.658	-1575.247	-1462.014	-1463.717	Laplace
2011	-1507.838	-1626.094	-1582.669	-1589.806	Laplace
2012	-1285.130	-1535.703	-1434.387	-1439.140	Laplace

Table C7: Akaike information criterion (AIC) statistics for the annual samples of profit rates (returns on assets) in non-manufacturing sector. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. As the last column shows, in 41 out of 42 years (98%), AIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

Year	Theoretical Distribution				Selection
	Gumbel	Laplace	Normal	Skew Normal	
1971	-1153.037	-1292.531	-1224.404	-1242.554	Laplace
1972	-1348.568	-1351.741	-1259.063	-1339.289	Laplace
1973	-1305.162	-1338.327	-1226.420	-1313.255	Laplace
1974	-1231.270	-1323.370	-1269.858	-1297.340	Laplace
1975	-1156.821	-1274.889	-1171.303	-1202.036	Laplace
1976	-1226.286	-1303.511	-1252.090	-1271.518	Laplace
1977	-874.164	-1300.712	-1205.115	-1205.913	Laplace
1978	-1038.353	-1302.181	-1219.524	-1227.862	Laplace
1979	-1075.794	-1288.797	-1247.618	-1247.707	Laplace
1980	-1135.929	-1315.607	-1241.428	-1266.202	Laplace
1981	-1221.549	-1298.900	-1286.663	-1293.373	Laplace
1982	-1103.506	-1369.419	-1272.027	-1283.135	Laplace
1983	-1190.753	-1364.347	-1262.049	-1279.811	Laplace
1984	-1168.889	-1381.868	-1295.463	-1300.922	Laplace
1985	-1157.523	-1386.770	-1312.643	-1316.419	Laplace
1986	-1169.667	-1351.847	-1277.237	-1284.259	Laplace
1987	-1246.084	-1382.232	-1304.202	-1321.390	Laplace
1988	-1303.604	-1433.560	-1422.625	-1420.536	Laplace
1989	-1471.866	-1473.356	-1468.817	-1487.205	Skew Normal
1990	-1448.180	-1535.142	-1497.674	-1508.764	Laplace
1991	-1238.583	-1507.833	-1394.334	-1414.667	Laplace
1992	-1434.592	-1524.527	-1448.953	-1473.655	Laplace
1993	-1395.785	-1483.237	-1438.074	-1449.745	Laplace
1994	-1290.655	-1502.683	-1443.525	-1439.945	Laplace
1995	-1326.375	-1541.339	-1469.889	-1467.502	Laplace
1996	-1227.402	-1557.603	-1477.382	-1480.804	Laplace
1997	-1138.715	-1585.609	-1503.311	-1510.895	Laplace
1998	-891.607	-1500.268	-1330.488	-1373.698	Laplace
1999	-1310.935	-1560.122	-1464.720	-1459.610	Laplace
2000	-829.662	-1558.008	-1351.458	-1405.913	Laplace
2001	-964.531	-1578.339	-1402.088	-1433.592	Laplace
2002	-979.107	-1597.815	-1412.877	-1450.733	Laplace
2003	-1012.529	-1612.583	-1461.010	-1492.394	Laplace
2004	-1152.826	-1576.964	-1426.868	-1423.953	Laplace
2005	-982.984	-1484.071	-1218.067	-1253.221	Laplace
2006	-1007.042	-1499.206	-1319.403	-1324.872	Laplace
2007	-1203.162	-1492.167	-1332.245	-1366.714	Laplace
2008	-587.319	-1328.289	-989.406	-999.521	Laplace
2009	-757.773	-1344.596	-1047.428	-1050.067	Laplace
2010	-1300.936	-1567.525	-1454.292	-1452.135	Laplace
2011	-1500.116	-1618.372	-1574.947	-1578.223	Laplace
2012	-1277.409	-1527.982	-1426.665	-1427.558	Laplace

Table C8: Bayesian information criterion (BIC) statistics for the annual samples of profit rates (returns on assets) in non-manufacturing sector. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. As the last column shows, in 41 out of 42 years (98%), BIC statistics support the Laplace distribution as a benchmark for the profit rate distribution.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	481.409	514.615	463.296	451.681	Skew Normal
1984	439.742	451.108	437.335	415.082	Skew Normal
1985	470.806	454.035	440.782	428.659	Skew Normal
1986	573.933	648.587	639.630	571.471	Skew Normal
1987	363.177	425.957	452.129	364.941	Gumbel
1988	228.714	293.586	315.493	227.712	Skew Normal
1989	248.911	328.249	343.842	250.350	Gumbel
1990	180.701	288.277	290.133	180.893	Gumbel
1991	138.148	196.807	237.908	147.161	Gumbel
1992	239.558	213.518	234.191	182.272	Skew Normal
1993	340.702	369.689	388.009	322.543	Skew Normal
1994	515.341	525.834	564.813	497.743	Skew Normal
1995	581.397	604.539	727.053	606.796	Gumbel
1996	648.509	597.063	696.617	608.562	Laplace
1997	522.439	387.499	476.702	426.095	Laplace
1998	513.682	355.867	441.468	398.857	Laplace
1999	594.753	477.432	551.647	502.359	Laplace
2000	717.908	681.791	754.294	689.411	Laplace
2001	819.759	853.923	859.976	802.530	Skew Normal
2002	795.551	832.989	859.545	778.314	Skew Normal
2003	619.599	605.050	690.437	605.633	Laplace
2004	416.749	425.502	482.305	407.913	Skew Normal
2005	493.625	476.316	518.578	461.246	Skew Normal
2006	502.830	468.475	541.223	469.236	Laplace
2007	446.110	392.183	475.251	408.574	Laplace
2008	446.846	422.486	476.945	420.034	Skew Normal
2009	424.183	392.344	414.105	386.138	Skew Normal
2010	164.130	135.330	165.488	150.943	Laplace
2011	168.041	114.851	134.625	131.465	Laplace
2012	149.156	109.435	132.792	121.705	Laplace

Table C9: Akaike information criterion (AIC) statistics for the annual samples of logarithm of Tobin's qs in manufacturing sector. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. Frequencies of selected distributions in the last column (in descending order) are as follows. Skew normal distribution: 14, Laplace distribution: 11, Gumbel distribution: 5, Normal distribution: 0. These results suggest that distributional properties of logarithm of Tobin's qs are highly unstable.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	1443.570	1567.027	1638.613	1458.826	Gumbel
1984	1494.534	1600.515	1767.719	1547.952	Gumbel
1985	1480.981	1577.907	1697.582	1520.956	Gumbel
1986	1745.263	1910.366	2251.893	1836.202	Gumbel
1987	1353.644	1504.545	1819.312	1439.737	Gumbel
1988	1162.163	1316.299	1603.110	1249.286	Gumbel
1989	1137.501	1296.146	1558.860	1205.862	Gumbel
1990	941.422	1113.177	1333.281	984.028	Gumbel
1991	788.651	930.291	1345.795	938.179	Gumbel
1992	579.973	708.088	966.732	673.066	Gumbel
1993	644.298	786.926	1071.553	735.163	Gumbel
1994	810.848	950.452	1448.017	993.781	Gumbel
1995	1013.412	1133.975	1960.277	1335.033	Gumbel
1996	935.253	1061.176	1923.147	1308.175	Gumbel
1997	506.153	598.168	1072.598	684.537	Gumbel
1998	443.976	527.642	944.093	596.676	Gumbel
1999	729.534	832.543	1195.921	847.839	Gumbel
2000	1093.674	1213.373	1791.288	1299.789	Gumbel
2001	1310.450	1466.688	2010.842	1493.829	Gumbel
2002	1230.318	1387.123	1892.697	1384.061	Gumbel
2003	870.062	994.349	1551.906	1065.407	Gumbel
2004	541.015	663.119	1004.364	643.569	Gumbel
2005	667.483	793.413	1155.296	790.991	Gumbel
2006	659.847	780.737	1360.958	888.151	Gumbel
2007	514.473	618.832	1102.979	694.357	Gumbel
2008	513.647	621.247	987.815	636.180	Gumbel
2009	465.286	552.189	737.521	522.893	Gumbel
2010	150.227	177.515	311.835	201.973	Gumbel
2011	109.678	126.786	194.988	133.924	Gumbel
2012	113.944	138.316	220.403	141.110	Gumbel

Table C10: Bayesian information criterion (BIC) statistics for the annual samples of logarithm of Tobin's qs in manufacturing sector. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. The last column shows that, for each annual sample in the entire sample period (1983-2012), BIC statistics support the Gumbel distribution as the best approximating model. The sharp difference in the model selection results between AIC and BIC seems to stem from the absence of penalty term on the sample size in AIC approach. Note, however, that the model selection results for annual samples under BIC approach are inconsistent with the result (the skew normal distribution) for pooled sample of logarithm of Tobin's qs (reported in Table 3), which leaves the presence of unique and stable distribution of Tobin's q highly obscure.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	269.049	308.420	302.861	270.000	Gumbel
1984	270.171	303.899	308.921	268.906	Skew Normal
1985	285.951	310.455	317.081	292.773	Gumbel
1986	371.905	458.747	452.766	352.206	Skew Normal
1987	276.107	356.240	366.382	277.456	Gumbel
1988	145.431	212.669	214.576	147.713	Gumbel
1989	124.176	171.431	186.450	132.739	Gumbel
1990	121.002	179.939	177.708	126.761	Gumbel
1991	45.384	104.551	127.938	57.860	Gumbel
1992	42.845	66.714	132.846	58.640	Gumbel
1993	61.294	29.707	119.138	59.847	Laplace
1994	77.391	46.838	155.957	92.594	Laplace
1995	80.747	45.528	194.025	111.369	Laplace
1996	84.916	46.795	145.256	90.156	Laplace
1997	40.362	-19.365	104.285	49.481	Laplace
1998	84.403	10.502	129.220	80.615	Laplace
1999	78.601	65.393	155.144	96.573	Laplace
2000	180.528	183.110	260.982	197.989	Gumbel
2001	244.211	251.994	308.851	253.940	Gumbel
2002	320.221	293.444	360.904	313.877	Laplace
2003	312.007	201.852	322.303	275.295	Laplace
2004	216.197	121.879	244.833	188.334	Laplace
2005	226.687	78.629	172.046	138.171	Laplace
2006	342.744	68.619	146.368	138.561	Laplace
2007	276.334	42.702	119.728	111.825	Laplace
2008	185.878	82.165	161.510	142.491	Laplace
2009	137.792	72.290	128.260	111.268	Laplace
2010	91.817	30.094	92.279	75.417	Laplace
2011	89.703	7.207	38.252	39.556	Laplace
2012	67.245	20.668	49.487	44.786	Laplace

Table C11: Akaike information criterion (AIC) statistics for the annual samples of logarithm of Tobin's qs in non-manufacturing sector. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. Frequencies of selected distributions in the last column (in descending order) are as follows. Laplace distribution: 18, Gumbel distribution: 10, Skew normal distribution: 2, Normal distribution: 0. These results suggest that distributional properties of logarithm of Tobin's qs are highly unstable.

	Theoretical Distribution				
Year	Gumbel	Laplace	Normal	Skew Normal	Selection
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	NA	NA	NA
1979	NA	NA	NA	NA	NA
1980	NA	NA	NA	NA	NA
1981	NA	NA	NA	NA	NA
1982	NA	NA	NA	NA	NA
1983	686.424	729.227	879.217	717.223	Gumbel
1984	722.786	760.682	947.193	772.583	Gumbel
1985	743.046	783.533	1014.898	824.078	Gumbel
1986	947.073	1036.177	1202.340	932.248	Skew Normal
1987	827.053	914.315	1133.472	863.058	Gumbel
1988	611.316	696.456	839.860	619.372	Gumbel
1989	565.968	642.885	816.710	614.755	Gumbel
1990	520.362	603.367	764.996	557.699	Gumbel
1991	395.280	474.346	691.596	463.258	Gumbel
1992	306.413	369.863	683.681	434.925	Gumbel
1993	249.329	289.148	650.075	405.250	Gumbel
1994	264.635	294.397	675.600	424.116	Gumbel
1995	277.726	300.787	804.536	502.632	Gumbel
1996	217.688	248.660	615.580	374.033	Gumbel
1997	119.326	130.044	561.312	308.977	Gumbel
1998	114.632	124.891	540.451	295.562	Gumbel
1999	157.986	195.406	560.376	309.547	Gumbel
2000	304.045	352.429	664.348	418.604	Gumbel
2001	391.315	446.976	717.088	483.345	Gumbel
2002	451.266	500.410	813.870	566.353	Gumbel
2003	377.930	398.661	804.785	541.867	Gumbel
2004	276.263	297.458	658.546	415.159	Gumbel
2005	201.073	222.496	523.765	318.276	Gumbel
2006	158.608	165.263	368.115	223.558	Gumbel
2007	114.580	110.197	324.289	185.870	Laplace
2008	144.701	148.879	411.661	246.835	Gumbel
2009	100.294	112.836	328.858	188.030	Gumbel
2010	55.254	54.489	220.768	120.180	Laplace
2011	10.557	-6.604	55.033	24.919	Laplace
2012	25.564	26.439	114.155	59.680	Gumbel

Table C12: Bayesian information criterion (BIC) statistics for the annual samples of logarithm of Tobin's qs in non-manufacturing sector. For the 1971-1982 period, the statistics are not reported due to the unavailability of market capitalization data. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. The last column shows that, in 26 out of 30 years (87%), BIC statistics support the Gumbel distribution as the best approximating model. The sharp difference in the model selection results between AIC and BIC seems to stem from the absence of penalty term on the sample size in AIC approach. Note, however, that the model selection results for annual samples under BIC approach are inconsistent with the result (the skew normal distribution) for pooled sample of logarithm of Tobin's qs (reported in Table 3), which leaves the presence of unique and stable distribution of Tobin's q highly obscure.

Industry Code	Gumbel	Laplace	Normal	Skew Normal	Selection
			Manufacturing Sector		
CGLAS	-5619.221	-5824.365	-5745.917	-5826.301	Skew Normal
CHEM	-17512.390	-18398.478	-18014.698	-18260.852	Laplace
DRUG	-2582.019	-2874.173	-2861.303	-2863.475	Laplace
EEQIP	-12956.730	-13773.634	-13352.409	-13552.484	Laplace
FOOD	-6739.181	-9630.584	-9038.613	-9036.613	Laplace
IRON	-5443.479	-6023.887	-5620.021	-5760.582	Laplace
MACH	-13531.971	-15658.449	-15123.612	-15146.772	Laplace
MOTOR	-6306.638	-6918.731	-6875.530	-6874.552	Laplace
MTLPR	-6021.098	-9250.921	-8725.455	-8728.413	Laplace
OTMFG	-4410.839	-4804.685	-4605.161	-4692.858	Laplace
PAPER	-2056.545	-2057.276	-2086.485	-2103.940	Skew Normal
PETRO	-956.844	-1116.021	-1091.836	-1090.683	Laplace
PRCSN	-2663.153	-2787.448	-2766.638	-2778.313	Laplace
RUBER	-2061.031	-2161.348	-2104.944	-2122.999	Laplace
SHPBLD	-812.297	-952.041	-862.378	-872.301	Laplace
TEXTL	-5897.168	-6438.193	-6240.553	-6269.917	Laplace
TREQP	-1127.573	-1168.680	-1139.241	-1163.764	Laplace
			Non-Manufacturing Sector		
AIR	-736.801	-857.520	-833.738	-831.738	Laplace
COMM	-554.929	-530.948	-551.496	-557.537	Skew Normal
CONST	-15337.729	-16010.124	-15600.014	-15939.700	Laplace
EPOWR	-1566.501	-1681.692	-1680.347	-1679.722	Laplace
GAS	-1152.300	-1121.182	-1088.527	-1153.173	Skew Normal
MARIN	-367.768	-354.651	-364.050	-367.415	Gumbel
MING	-660.700	-735.852	-676.269	-690.974	Laplace
RANDE	-1545.374	-2806.771	-2385.089	-2637.325	Laplace
RETAL	-3337.231	-3438.417	-3477.815	-3490.761	Skew Normal
RL	-4898.294	-5445.037	-5419.484	-5457.970	Skew Normal
SEATR	-1498.989	-1635.623	-1337.683	-1471.813	Laplace
SRVS	-4475.602	-4724.741	-4331.319	-4559.222	Laplace
TRADE	-7963.932	-13695.082	-12359.980	-12418.298	Laplace
TRK	-2431.550	-2380.103	-2401.760	-2434.446	Skew Normal
WRHSG	-3736.260	-4459.800	-4330.182	-4336.644	Laplace

Table C13: Akaike information criterion (AIC) statistics for the pooled sample of profit rates in each individual industry. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. As the last column shows, in 24 out of 32 industries (75%), AIC statistics support the Laplace distribution as a benchmark for the profit rate distribution. Under two sector decomposition, the model selection results sustain the validity of Laplace distribution for 15 out of 17 manufacturing industries (88%) and 9 out of 15 non-manufacturing industries (60%).

Industry Code	Gumbel	Laplace	Normal	Skew Normal	Selection
			Manufacturing Sector		
CGLAS	-5608.470	-5813.615	-5735.167	-5810.175	Laplace
CHEM	-17499.477	-18385.566	-18001.786	-18241.483	Laplace
DRUG	-2572.273	-2864.427	-2851.557	-2848.856	Laplace
EEQIP	-12944.084	-13760.988	-13339.763	-13533.516	Laplace
FOOD	-6727.267	-9618.669	-9026.699	-9018.742	Laplace
IRON	-5432.435	-6012.843	-5608.977	-5744.017	Laplace
MACH	-13519.023	-15645.502	-15110.664	-15127.350	Laplace
MOTOR	-6295.594	-6907.687	-6864.486	-6857.986	Laplace
MTLPR	-6009.337	-9239.159	-8713.694	-8710.770	Laplace
OTMFG	-4400.310	-4794.157	-4594.633	-4677.066	Laplace
PAPER	-2048.099	-2048.831	-2078.040	-2091.272	Skew Normal
PETRO	-949.477	-1108.654	-1084.469	-1079.632	Laplace
PRCSN	-2653.686	-2777.981	-2757.172	-2764.112	Laplace
RUBER	-2052.426	-2152.742	-2096.339	-2110.091	Laplace
SHPBLD	-805.238	-944.982	-855.319	-861.713	Laplace
TEXTL	-5886.266	-6427.290	-6229.650	-6253.563	Laplace
TREQP	-1120.206	-1161.313	-1131.874	-1152.714	Laplace
			Non-Manufacturing Sector		
AIR	-730.107	-850.826	-827.044	-821.697	Laplace
COMM	-548.681	-524.700	-545.248	-548.165	Gumbel
CONST	-15325.232	-15997.627	-15587.517	-15920.954	Laplace
EPOWR	-1558.631	-1673.823	-1672.477	-1667.917	Laplace
GAS	-1144.933	-1113.815	-1081.160	-1142.122	Gumbel
MARIN	-362.906	-349.789	-359.189	-360.123	Gumbel
MING	-654.006	-729.157	-669.575	-680.933	Laplace
RANDE	-1536.118	-2797.515	-2375.833	-2623.441	Laplace
RETAL	-3327.666	-3428.852	-3468.251	-3476.415	Skew Normal
RL	-4888.463	-5435.205	-5409.652	-5443.223	Skew Normal
SEATR	-1490.544	-1627.178	-1329.238	-1459.145	Laplace
SRVS	-4465.074	-4714.213	-4320.791	-4543.429	Laplace
TRADE	-7951.718	-13682.867	-12347.765	-12399.977	Laplace
TRK	-2422.945	-2371.498	-2393.155	-2421.538	Gumbel
WRHSG	-3726.193	-4449.733	-4320.115	-4321.543	Laplace

Table C14: Bayesian information criterion (BIC) statistics for the pooled sample of profit rates in each individual industry. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. As the last column shows, in 25 out of 32 industries (78%), BIC statistics support the Laplace distribution as a benchmark for the profit rate distribution. Under two sector decomposition, the model selection results sustain the validity of Laplace distribution for 16 out of 17 manufacturing industries (94%) and 9 out of 15 non-manufacturing industries (60%).

Industry Code	Gumbel	Laplace	Normal	Skew Normal	Selection
			Manufacturing Sector		
CGLAS	1662.432	1937.257	2198.028	1644.935	Skew Normal
CHEM	5091.148	5826.164	6580.926	5137.386	Gumbel
DRUG	1729.411	1880.851	2063.668	1731.645	Gumbel
EEQIP	5088.123	5697.750	6796.388	5321.080	Gumbel
FOOD	2959.964	3367.189	3956.861	3052.487	Gumbel
IRON	1883.752	2167.292	2479.912	1924.135	Gumbel
MACH	5948.311	6704.514	7768.250	6066.661	Gumbel
MOTOR	2105.272	2373.649	3286.851	2391.808	Gumbel
MTLPR	3334.947	3740.039	4866.611	3655.857	Gumbel
OTMFG	1623.230	1842.124	2354.359	1677.273	Gumbel
PAPER	302.342	381.033	482.627	306.506	Gumbel
PETRO	176.858	211.314	269.029	191.832	Gumbel
PRCSN	1288.902	1429.282	1757.372	1366.773	Gumbel
RUBER	558.996	652.743	733.502	554.517	Skew Normal
SHPBLD	84.436	131.581	134.269	72.259	Skew Normal
TEXTL	1946.035	2165.699	2759.806	2066.181	Gumbel
TREQP	486.326	539.404	624.089	477.149	Skew Normal
			Non-Manufacturing Sector		
AIR	262.417	284.175	329.360	265.972	Gumbel
COMM	323.834	355.803	388.588	311.356	Skew Normal
CONST	2326.257	2836.803	3533.137	2459.637	Gumbel
EPOWR	-158.693	-156.234	-149.670	-162.706	Skew Normal
GAS	248.354	290.607	358.922	252.628	Gumbel
MARIN	45.619	60.901	67.621	36.912	Skew Normal
MING	325.120	342.903	455.584	360.007	Gumbel
RANDE	1341.656	1406.963	2043.395	1555.593	Gumbel
RETAL	793.280	936.493	1064.842	793.124	Skew Normal
RL	594.015	743.034	948.748	575.536	Skew Normal
SEATR	695.589	772.186	923.202	728.793	Gumbel
SRVS	3305.505	3525.639	4344.154	3459.013	Gumbel
TRADE	1545.242	1828.412	3007.284	1944.889	Gumbel
TRK	656.760	760.346	847.067	638.636	Skew Normal
WRHSG	1300.952	1454.305	1747.138	1293.996	Skew Normal

Table C15: Akaike information criterion (AIC) statistics for the pooled sample of logarithm of Tobin's qs in each individual industry. Selection criterion for best approximating theoretical distribution is based on the lowest AIC score. As the last column shows, in 21 out of 32 industries (66%), AIC statistics support the Gumbel distribution as a benchmark for the Tobin's q distribution. Under two sector decomposition, the test results sustain the validity of the Gumbel distribution for 13 out of 17 manufacturing industries (76%) and 8 out of 15 non-manufacturing industries (53%).

Industry Code	Gumbel	Laplace	Normal	Skew Normal	Selection
			Manufacturing Sector		
CGLAS	1672.219	1947.044	2207.816	1659.616	Skew Normal
CHEM	5103.108	5838.124	6592.886	5155.325	Gumbel
DRUG	1738.231	1889.671	2072.488	1744.875	Gumbel
EEQIP	5099.845	5709.472	6808.110	5338.663	Gumbel
FOOD	2970.950	3378.175	3967.846	3068.965	Gumbel
IRON	1893.817	2177.357	2489.977	1939.232	Gumbel
MACH	5960.382	6716.585	7780.321	6084.767	Gumbel
MOTOR	2115.434	2383.811	3297.013	2407.051	Gumbel
MTLPR	3345.788	3750.880	4877.452	3672.118	Gumbel
OTMFG	1632.855	1851.749	2363.984	1691.710	Gumbel
PAPER	309.776	388.467	490.061	317.657	Gumbel
PETRO	183.211	217.667	275.381	201.361	Gumbel
PRCSN	1297.492	1437.872	1765.962	1379.659	Gumbel
RUBER	566.683	660.430	741.189	566.048	Skew Normal
SHPBLD	90.599	137.744	140.432	81.503	Skew Normal
TEXTL	1955.936	2175.600	2769.708	2081.033	Gumbel
TREQP	492.820	545.898	630.583	486.890	Skew Normal
			Non-Manufacturing Sector		
AIR	268.058	289.816	335.001	274.433	Gumbel
COMM	329.217	361.186	393.971	319.430	Skew Normal
CONST	2337.875	2848.421	3544.755	2477.064	Gumbel
EPOWR	-151.861	-149.402	-142.838	-152.458	Skew Normal
GAS	254.816	297.069	365.384	262.321	Gumbel
MARIN	49.560	64.842	71.562	42.823	Skew Normal
MING	330.871	348.654	461.334	368.633	Gumbel
RANDE	1349.914	1415.221	2051.653	1567.980	Gumbel
RETAL	801.982	945.194	1073.544	806.177	Gumbel
RL	602.724	751.743	957.457	588.599	Skew Normal
SEATR	703.163	779.759	930.776	740.154	Gumbel
SRVS	3315.154	3535.288	4353.803	3473.486	Gumbel
TRADE	1556.555	1839.725	3018.596	1961.858	Gumbel
TRK	664.459	768.044	854.765	650.184	Skew Normal
WRHSG	1309.942	1463.295	1756.128	1307.482	Skew Normal

Table C16: Bayesian information criterion (BIC) statistics for the pooled sample of logarithm of Tobin's qs in each individual industry. Selection criterion for best approximating theoretical distribution is based on the lowest BIC score. As the last column shows, in 22 out of 32 industries (69%), BIC statistics support the Gumbel distribution as the best approximating model. Under two sector decomposition, the test results sustain the validity of the Gumbel distribution for 13 out of 17 manufacturing industries (76%) and 9 out of 15 non-manufacturing industries (60%).

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