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Dividend payout ratio follows a Tweedie distribution: international evidence

Victor Dragota, Daniel Traian Pele, and Hanaan Yaseen

Abstract
Dividend policy is still a largely discussed issue in corporate finance literature. One of the main indicators used in analysing the dividend policy is the dividend payout ratio. Using a database consisting of 12,085 companies operating in 73 countries, for the period 2008–2014, the authors found that the dividend payout ratio follows a Tweedie distribution, and not a normal one. This distribution is stable over time for the entire analysed period. In addition, it describes the case of almost all the countries included in the sample. Thus, a better estimation of the probability that dividend payout ratio is lower or higher than a benchmark can be provided. Also, an analysis of dividend policy, distinctly considering payer versus non-payer companies, can offer additional important information for both practitioners and academics.

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Keywords Dividend policy; dividend payout ratio; Tweedie distribution

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1 INTRODUCTION

Corporate finance literature discusses dividend policy from different perspectives (Lintner 1956, Miller and Modigliani 1961, Bhattacharya 1979, Easterbrook 1984, La Porta et al. 2000, Fama and French 2001, Fidrmuc and Jacob, 2010, Floyd et al, 2015, Jiang et al. 2017, etc.). Different viewpoints on dividend policy are contradictory, from its neutral impact on firms' value (Miller and Modigliani 1961) to normative advices to increase (Graham and Dodd 1951) or to decrease (Walter 1956) the amount paid to shareholders, or to finding agency problems, asymmetrical information, socio-cultural or institutional factors as possible explanations for this financial decision (Bhattacharya 1979, Easterbrook 1984, La Porta et al. 2000, Fidrmuc and Jacob 2010, etc.). Among them, the studies concerning the factors determining dividend payout are an important direction (see, among others, La Porta et al. 2000, Fidrmuc and Jacob 2010, Nicolosi 2013).

Different indicators are used for modelling dividend policy. One of the most important and commonly used is the dividend payout ratio (hereafter, DPR), respectively the part of the net earnings paid to shareholders, as dividends, considering the firms which record net profits (and excluding those which record losses)[1]. In a sense, DPR reflects exactly the interest expressed by one profitable company for paying dividends to its shareholders. Analysed for one period, a DPR equal to 100% reflects a totally dedicated policy to pay dividends to shareholders, and one of 0% a reflection of a non-interest to dividends (argued in many cases as the company's interest for investing). DPR is used in a large variety of studies, as dependent variable (e.g., La Porta et al. 2000, Faccio et al. 2001, Fidrmuc and Jacob 2010, Jiang et al. 2017, etc.), but also as explanatory variable in different contexts (e.g., Lintner 1956, Arnott and Asness 2003, Baker et al. 2012, He et al. 2017). In such studies, the average DPR is often considered representative, as in the case of a Gaussian distribution.

Many papers analyse the determining factors of DPR using a classical regression (e.g., La Porta et al. 2000, Fidrmuc and Jacob 2010, Jiang et al 2017). Other papers analyse the propensity to pay dividends[2] and its determinants (e.g., Denis and Osobov 2008, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013, Banyi and Kahle 2014, Jiang et al 2017). One missing link between considering the averages DPR and the propensity to pay dividends in modelling dividend policy can be somehow intuited. DPR does not follow a normal distribution. Figure 1 depicts DPR distribution for a number of 12,085 companies from 73 countries, in the period 2008-2014. In this study, we show that this empirical distribution may be fitted at best by a Tweedie distribution. Moreover, this distribution is stable in time for the entire analysed period. In addition, it describes the case of almost all the countries included in the sample and the most part of the years (some more detailed statistics are provided in Appendix 1). This is the main contribution of our study.

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[1] DPR can be also calculated as ratio between dividend per share and earnings per share. This second expression is the most familiar for investors on capital market.

[2] Denis and Osobov (2008) define the propensity to pay dividends, respectively the characteristic of one company to be a dividend payer or not. If DPR = 0, the company is a dividend payer. If DPR > 0, the company is not a dividend payer.

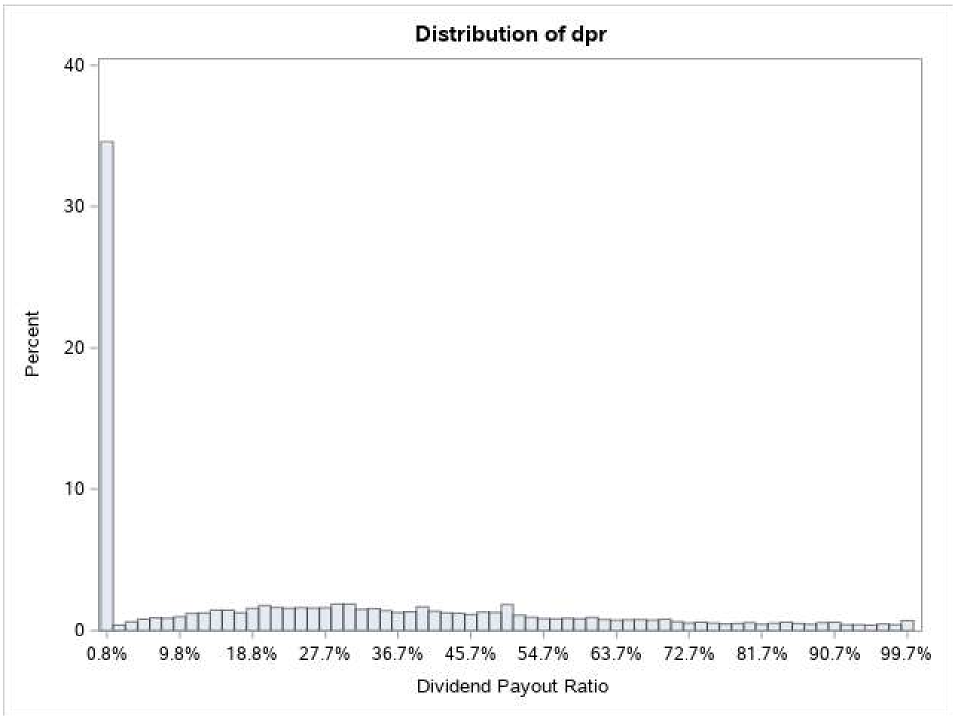

Figure 1. Dividend payout ratio for the companies included in the sample, in the period 2008-2014. All companies' financials were collected from the Thomson Research Worldscope database. DPR is computed as: $DPR = \frac{Dividends}{Net\ income}$**.**

The distribution depicted in Figure 1 suggests that dividend policy is mainly an issue of "to be or not to be" a dividend payer, some authors suggesting the decrease in dividend payments in time (Fama and French 2001, Fatemi and Bildik 2012, Kuo et al. 2013), which can be modelled through the propensity to pay dividends (Fama and French 2001, Denis and Osobov 2008, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013, Banyi and Kahle 2014, Floyd et al. 2015, Jiang et al. 2017, etc.). As practical implication, a proper analysis of DPR should consider both components of the distribution – the 0 inflated component and the distribution for DPR > 0. However, as Figure 1 suggests, this is not a 0% / 100% dividend payout ratio policy! An analysis concerned only about the decision to pay or not to pay dividend can miss some important information.

The most appropriate distribution for modelling DPR is not the normal (Gaussian) one, but the less used Tweedie distribution, proposed by Maurice Tweedie (1984). Using a better fit for the distribution, a better estimation of the probability that the event to occur (e.g., DPR to be lower or higher than a benchmark) can be provided. Also, an analysis of dividend policy, distinctly considering payer versus non-payer companies, can offer additional important information for practitioners and academics.

The remainder of our paper is structured as follows. Some related studies are discussed in Section 2. Section 3 presents the methodology. Section 4 describes the data. Section 5 presents and examine the results. In Section 6, we conclude.

2 RELATED STUDIES: DIVIDEND PAYOUT RATIO AS EXPLAINING THE DIVIDEND POLICY

Different indicators are used for modelling dividend policy, in various contexts (see Table 1). Of course, each of these indicators expresses something else, but all of them can be used in analysing dividend policy.

Table 1: Indicators used in modelling dividend policy

Indicator	Studies
Dividend payout ratio (dividend-to-earnings ratio)	Lintner (1956), La Porta et al. (2000), Faccio et al. (2001), Aivazian (2003), Fidrmuc and Jacob (2010), Fatemi and Bildik (2012), Floyd et al. (2015), He et al. (2017), Jiang et al. (2017), Chen et al. (2017)
Propensity to pay dividends	Fama and French (2001), Denis and Osobov (2008), von Eije and Megginson (2008), Bena and Hanousek (2008), Fatemi and Bildik (2012), Kuo et al. (2013), Banyi and Kahle (2014), Floyd et al. (2015), He et al. (2017), Jiang et al. (2017), Chen et al. (2017),
Dividends / sales	La Porta et al. (2000), Faccio et al. (2001), Shao et al. (2010), Fidrmuc and Jacob (2010), Chen et al. (2017)
Dividends / cash flow	La Porta et al. (2000), Faccio et al. (2001), Fidrmuc and Jacob (2010), Jiang et al. (2017)
Dividend / earnings before interest and taxes	Renneboog and Trojanowski (2007)
Dividends / market capitalization (Dividend yield)	Faccio et al. (2001), Aivazian (2003), Nicolosi (2013), Arnott and Asness (2003), Desai and Jin (2011), He et al. (2017), Chen et al. (2017)
Dividends / assets	Shao et al. (2010), Chen et al. (2017)
Dividend initiation and omission	DeAngelo and DeAngelo (1990), Huang et al. (2015), He et al. (2017), Chen et al. (2017)
Dividend per share	Bena and Hanousek (2008)
Dividend payments	Lintner (1956), Renneboog and Trojanowski (2007)

One of the most important from this list of indicators is DPR, respectively the ratio between net dividend paid to shareholders and net earnings (for instance, dividend payout ratio in the year *t*, as a ratio between dividend per share and earnings per share, both recorded in the year *t*) and calculated only if the company records profit, and not loss (La Porta et al. 2000, Fidrmuc and Jacob 2010). Net dividend is considered usually as total cash dividend paid to common and preferred shareholders (La Porta et al. 2000, Fidrmuc and Jacob 2010)[3]. DPR can be considered as explaining the interest of the shareholders for receiving dividends (or, in

[3] In some cases, supplementary adjustments are made. For instance, "Earnings are measured after taxes and interest but before extraordinary items" (La Porta et al. 2000).

some cases, the interest of managers to protect the shareholders' interests). Share repurchases can be considered as an alternative to dividend payments (La Porta et al. 2000, von Eije and Megginson 2008, Fidrmuc and Jacob 2010, Banyi and Kahle 2014, Baker and Weigand 2015); however, excepting some studies (e.g., Renneboog and Trojanowski 2007, Floyd et al 2015), DPR is not corrected for accounting for this type of shareholders' remuneration[4].

Undoubtedly, as most of the financial indicators, DPR has certain limits. Net earnings depend on the countries' accounting conventions and are not always comparable from one country to another, being also easily manipulated by "accounting tricks". Also, "diversion of resources may occur before earnings are reported" (in this case, dividend payout ratio "overestimates the share of true earnings that is paid as dividends" (La Porta et al. 2000)[5]. It can be stated that DPR is also a classical, traditional indicator. It expresses the share of profit paid to shareholders. In this vision, profit is somehow considered having "a cash flow essence". As signalling theory notices (Bhattacharya 1979, Kalay 1980), in practice, one company can record profits, but having not enough cash for paying dividends. Also, if one company pays dividends from previous years earnings (from reserves), DPR can be higher than 100%. This non-synchronicity between dividends (an amount paid from the cash existent in one financial exercise) and net earnings (the result in previous year) can complicate also the financial interpretation of DPR.

DPR does not reflect a return (like dividend yield); it is a share of profit paid to shareholders. If dividends and retained earnings are considered as expressing opposite interests (see the literature regarding minority shareholders' protection, e.g., La Porta et al. 2000), DPR would reflect a higher interest for one issue or another or, maybe, a power in negotiation. However, the interpretation of the indicator should be made cautiously. If one company records 100 monetary units (m.u.) as earnings and pays 50 m.u. as dividends, it records only a 50% DPR, comparatively with another, which pays 100% as dividends from its 1 m.u. earnings. Looking only to DPR, the second one seems to be more oriented to shareholders.

DPR is used as dependent variable in regressions (La Porta et al. 2000, Fidrmuc and Jacob 2010, Jiang et al 2017). Different factors are considered as determinants of DPR, some of them – financial (e.g., size, return of assets, leverage, sales growth, in Fidrmuc and Jacob 2010, Jiang et al 2017), other – legal (legal system, mandatory dividends, tax advantages, etc., as in La Porta et al. 2000, Fidrmuc and Jacob 2010, etc.), cultural (individualism, power distance, uncertainty avoidance[6], in Fidrmuc and Jacob 2010), related to ownership structure (Jiang et al 2017), etc.

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[4] Share repurchases imply the termination of the role as shareholder for the receiver of the payment, and this can explain why it can be analyzed independently by the dividend policy.

[5] These problems are solved somehow using dividend-to-sales or dividend-to-cash flow ratios (La Porta et al. 2000, Faccio et al. 2001, Fidrmuc and Jacob 2010, etc.). However, these indicators do not reflect a portion from net earnings paid as dividend, dividends being defined as a part of the earnings distributed to shareholders.

[6] These indicators are proposed by Hofstede (2001), as proxies for the national culture.

Based on empirical evidences, different papers found that the presence of non-paying dividends companies is significant (Fama and French 2001, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013). For this reason, many papers prefer to analyse the propensity to pay dividends and its determinants (e.g., Denis and Osobov 2008, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013, Banyi and Kahle 2014, Jiang et al. 2017).

One missing link between considering averages DPR and propensity to pay dividends in modelling dividend policy can be somehow intuited. On the one hand, the use of the average DPR can be misleading, as long as DPR is 0% in many cases. An average DPR should be interpreted cautiously; it is as if you would say that in average you feel all right if one part of you is kept in frozen water and the other one in boiling water. On the other hand, neglecting the distribution of DPR in the absence of DPR = 0 (considering 1% DPR to be as such important as a 100% DPR) can determine missing some information.

3 METHODOLOGY

Our methodology is focused on finding the most appropriate distribution for DPR.

Tweedie distribution (Tweedie 1984) is included in the class of exponential dispersion models. Some familiar distributions are special cases of the Tweedie distribution (e.g., normal, Poisson, compound Poisson gamma distribution, etc.). Tweedie distribution are a family of distributions that includes the normal distribution, the gamma distribution, and the class of mixed compound Poisson–gamma distributions, which have positive mass at zero, but are otherwise continuous. Tweedie distribution is a special case of exponential dispersion models, a class of models used to describe error distributions for the generalized linear model.

If Y is a Tweedie random variable, then the mean and the variance are $E(Y)=\mu$ and $Var(Y)=\phi\mu^{p}$, where ϕ is the dispersion parameter and p is an extra parameter that controls the variance of the distribution. The Tweedie distribution is not defined when p is between 0 and 1. In practice, the most interesting range is from 1 to 2, in which the Tweedie distribution gradually loses its mass at 0 as it shifts from a Poisson distribution to a gamma distribution. For $p>1$, the Tweedie probability density function (pdf) has the following form:

$$f(x;\mu,\phi,p)=a(x,\phi)\exp\left[\frac{1}{\phi}\left(\frac{x\mu^{1-p}}{1-p}-k(\mu,p)\right)\right] \tag{1}$$

Where $k(\mu,p)=\begin{cases}\dfrac{\mu^{2-p}}{2-p}, for\ p\neq 2,\\ log(\mu), for\ p=2\end{cases}$, while the function $a(x,\phi)$ has no closed analytical expression.

For $1<p<2$, the Tweedie distribution (denoted here Tweedie (μ, ϕ, p)) is a compound Poisson-gamma mixture distribution, which is the distribution of S defined as $S = \sum_{i=1}^{N} X_i$, where $N \sim Poisson\ (\lambda)$ and $X_i \sim$ gamma (α, θ) are i.i.d. gamma random variables with shape parameter α and scale parameter θ. The correspondence between these parameters and the parameters of the Tweedie distribution is the following:

$$\begin{cases} \lambda = \dfrac{\mu^{2-p}}{\phi(2-p)} \\ \alpha = \dfrac{2-p}{p-1} \\ \theta = \phi(p-1)\mu^{p-1} \end{cases} . \tag{2}$$

The Scaled Tweedie distribution (denoted here STweedie (θ, λ, p)) is a version of the Tweedie distribution, corresponding to a compound Poisson-gamma distribution with gamma scale parameter θ, Poisson parameter λ, and the index parameter p such as $\alpha = \dfrac{2-p}{p-1}$ (Dunn and Smyth 2005).

The correspondence between the parameters of the STweedie (θ, λ, p) distribution and the Tweedie (μ, ϕ, p) distribution is the following:

$$\begin{cases} \mu = \lambda\theta\alpha \\ \phi = \dfrac{(\lambda\theta\alpha)^{2-p}}{\lambda(2-p)} = \dfrac{\theta}{(p-1)(\lambda\theta\alpha)^{p-1}} \end{cases} . \tag{3}$$

We have visually analysed the distribution and performed Anderson-Darling test, as an empirical distribution function omnibus test, for the hypothesis of Tweedie distribution for DPR.

4 DATA

All companies' financials were collected from the Thomson Research Worldscope database[7]. We included in our database only those countries with minimum 10 companies available for the entire period (for this reason, we excluded from the initial database some countries). In addition, we have not considered the financial institutions because of the difference in the accounting standards for financial reporting, as La Porta et al. (2000), Fidrmuc and Jacob (2010), Jiang et al. (2017), etc.[8]. In addition, we imported from the original database

[7] The access to the Thomson Research Worldscope Database was granted by Deloitte Romania.

[8] Different studies, after the exclusion of companies with missing values, exclude from their databases: (i) utility companies (Fidrmuc and Jacob, 2010); (ii) companies from Luxembourg (La Porta et al. 2000, Fidrmuc and Jacob 2010); (iii) companies completely or partially owned by the governments (La Porta

only companies which had data available for the entire period analysed. In addition, we excluded from our database those companies which recorded negative net income (as in La Porta et al. 2000, Fidrmuc and Jacob 2010). The inclusion of this kind of data is incoherent with the financial logic of the indicator – dividend payout ratio is defined as a *share of profit* paid to shareholders. Another criterion for the imported data from Thomson Research Worldscope was that dividend payout ratio should be greater or equal than zero (to eliminate possible abnormal negative dividend payout ratio) (Jiang et al. 2017). We considered only cash dividends and no other forms of shareholder's remuneration (such as shares repurchases) (as Floyd et al. 2015, among others) (due to data availability) or other "cosmetically" (non-cash) operations (e.g., dividends in stocks).

The final database consists of 12,085 companies operating in 73 countries in the period 2008-2014. As such, our database covers a crisis and post-crisis period. The data are winsorized to 2% and DPR is limited to 100%.[9] We have considered each company as being a different and sole company, in the case of a group of companies, which activates in more than one country[10].

Appendix 2 presents the descriptive statistics for DPR for the analysed countries. The number of companies per country is constant for the entire period analysed and the average number of companies per country is 168. Table 2 provides much more details about the process of building the final sample.

et al. 2000); (iv) companies from socialist or former socialist countries (La Porta et al. 2000). We included these categories for assuring a larger perspective on DPR. As observation, in our database, inclusion of Luxembourg does not have an important impact, as long it counts only with 56 records. In addition, even some particularities persist for the economies of socialist or former socialist countries, we do not consider them significant at this moment for the purpose of our study.

[9] In some cases, the rough data is questionable per se. In this category can be mentioned companies with negative dividends (reported also in Fidrmuc and Jacob 2010), or with dividends exceeding sales (reported in La Porta et al. 2000, Fidrmuc and Jacob 2010). The quality of the databases used can be a problem. For instance, Fidrmuc and Jacob (2010) use as main source of data "Standard & Poor's Capital IQ database, which provides data covering company information for 58,670 public companies". From this total number of companies, the authors exclude 37,109 companies (that means approximately 63.25%!!!), because they have missing dividend data, negative dividends or dividends exceeding sales. DPR can be greater than 100% if dividends are paid from reserves. We did not consider this case for the reasons explained in Section 2.

[10] Relatively the same database was used in Yaseen and Dragotă (2019) and Yaseen (2019), for different proposes.

Table 2: Final sample construction

Description	Companies
Total number of companies imported from the database	14,071
Banks and investment trust	1,540
Companies without a specific industry (not mentioned in the database)	30
National Banks	2
Negative Assets, Negative Sales, Negative Income or other aberrant financial data	336
Companies from countries with less than 10 companies	78
Final Sample	**12,085**

Appendix 1 presents DPR distributions for the countries included in our sample, for the period 2008-2014. In almost all of the cases (53 countries from 73, respectively 72.6% from the total population), DPR distribution is zero inflated (the modal value of the distribution equals 0)[11].

One issue that can be considered is the mandatory dividend, respectively a legal requirement that a fraction of earnings to be paid as dividend[12]. The results (somehow surprising) confirm the same distribution even for the cases of the countries with regulated dividend payment. The mode for DPR for Brazil, Greece, Peru, Philippines and Venezuela is zero, and the percent of companies that do not pay dividends in Chile is important (44%).[13]

Table 3 provides the descriptive statistics for DPR. As observation, a look only to the mean (and to the median) of the population can be misleading. The mode is 0% and a closer look to the distribution of the variable confirms that, for the entire population, but also for the majority of the countries, the distribution of DPR is a zero-inflated distribution - the mode being 0, with the corresponding probability significantly higher than the other probabilities. This phenomenon is documented also by many other studies (Fama and French 2001, Denis and Osobov 2008, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013).

[11] The case of Oman is somehow between DPR zero-inflated distribution and the other case (see Appendix 1), but the same pattern as in the general case can be suspected, too.

[12] La Porta et al. (2000) mention as countries with a mandatory dividend Brazil, Chile, Colombia, Greece, Venezuela and, in some extent, Germany. La Porta et al. (2000) exclude these countries from their analysis from the beginning. However, they mention that "they nevertheless appear, in the data, to have lower payouts than required by the law. A possible reason for this is that the accounting earnings reported to the authorities for the purpose of compliance with mandatory dividend rules are lower than the earnings reported to the shareholders which we use in our analysis". La Porta et al. (2000) use the March 1996 edition of the WorldScope Database, "which presents information on the (typically) largest firms in 46 countries". According to Fidrmuc and Jacob (2010), such requirements are present in Brazil, Chile, Greece, Peru, and the Philippines. Huang et al. (2015) mention in this category Brazil, Chile, Colombia, Greece, and Venezuela. The differences can be related not only to the countries included in the database, but also to the moment of analysis.

[13] Colombia is not included in our database.

Table 3: Descriptive Statistics for Dividend Payout Ratio

Number of records	71,824	Interquartile Range	47.06%
Mean	27.734%	Variance	0.081
Standard Deviation	28.383%	Excess Kurtosis	-0.462
Skewness	0.767	Standard Error Mean	0.001
Coefficient of Variation	102.338	Median	21.840%
		Mode	0.00%

5 RESULTS

Analysing visually the histogram of distribution, it can be easily observed that it is a zero-inflated distribution (see also Appendix 3). Statistical literature documents the existence of different zero-inflated distributions (e.g., Poisson, Gamma, Tweedie) (El-Shaarawi, Zhu and Joe 2011, Jørgensen and Kokonendji 2016, Bonat and Kokonendji 2017).

The Anderson-Darling test confirms that the Tweedie distribution characterizes the best DPR distribution (see Table 4). Figure 2 explains graphically this choice. Figure 2 depicts the empirical distribution function of DPR versus the estimated Tweedie Cumulative Distribution Function. It can be observed that the estimated Tweedie distribution fits the best the empirical distribution of DPR, out the selected probability density functions. Figure 3 fits the empirical distribution with the Tweedie distribution. Figure 4 shows the conditional probability density function estimates for Tweedie distribution against the empirical distribution: Tweedie distribution is a good choice in approximating the real distribution.

Table 4: Model Selection based on the Anderson-Darling test

Distribution	**Converged**	**Anderson-Darling Statistic**	**Selected**
Tweedie	Yes	-52014	Yes
Scaled Tweedie	Yes	-52011	No
Lognormal	Yes	-48101	No
Burr	No	-47679	No
Weibull	Yes	-47519	No
Inverse Gaussian	Yes	-45203	No
Exponential	Yes	-41865	No
Generalized Pareto Distribution	Yes	-41856	No
Pareto	Yes	-41710	No
Gamma	Yes	-35549	No

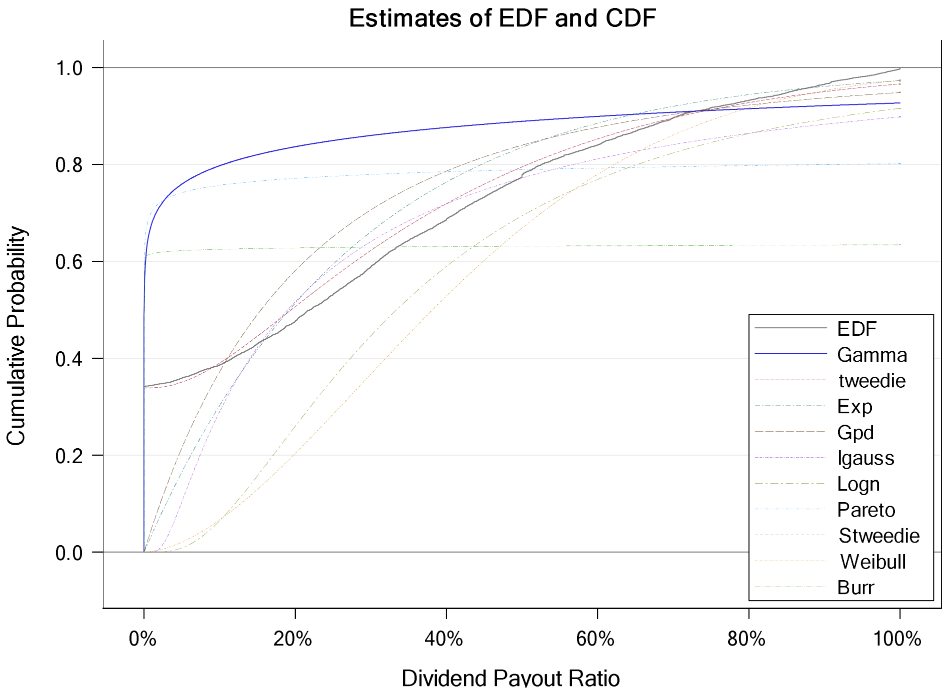


Figure 2: Estimates of Empirical Distribution Function of Dividend Payout Ratio (EDF) and other distributions

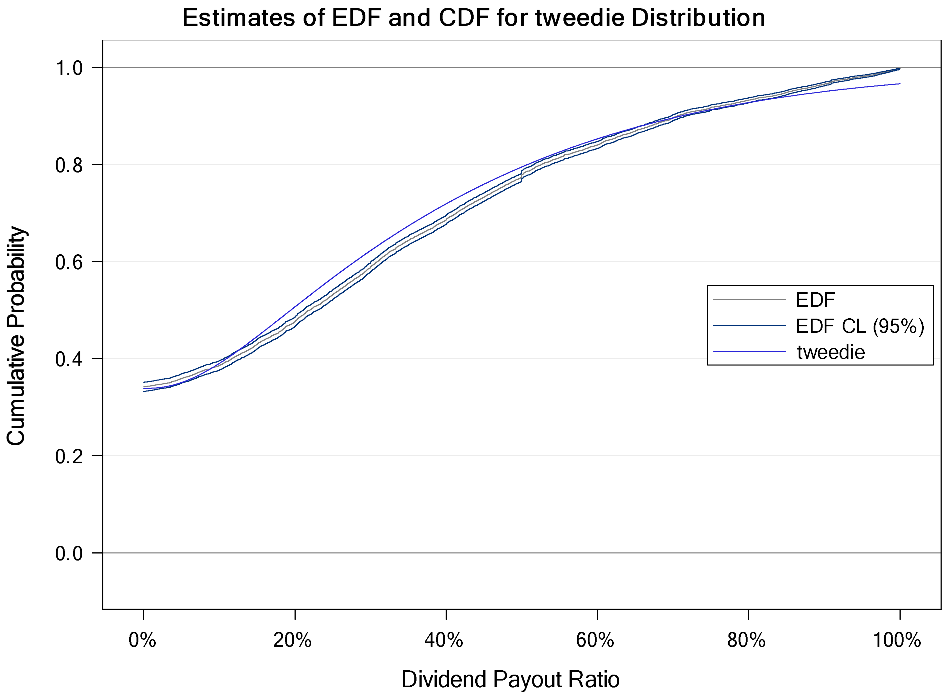


Figure 3: Empirical Distribution Function of Dividend Payout Ratio (EDF) versus the estimated Tweedie Cumulative Distribution Function

Note: In this figure, CL means confidence limit.

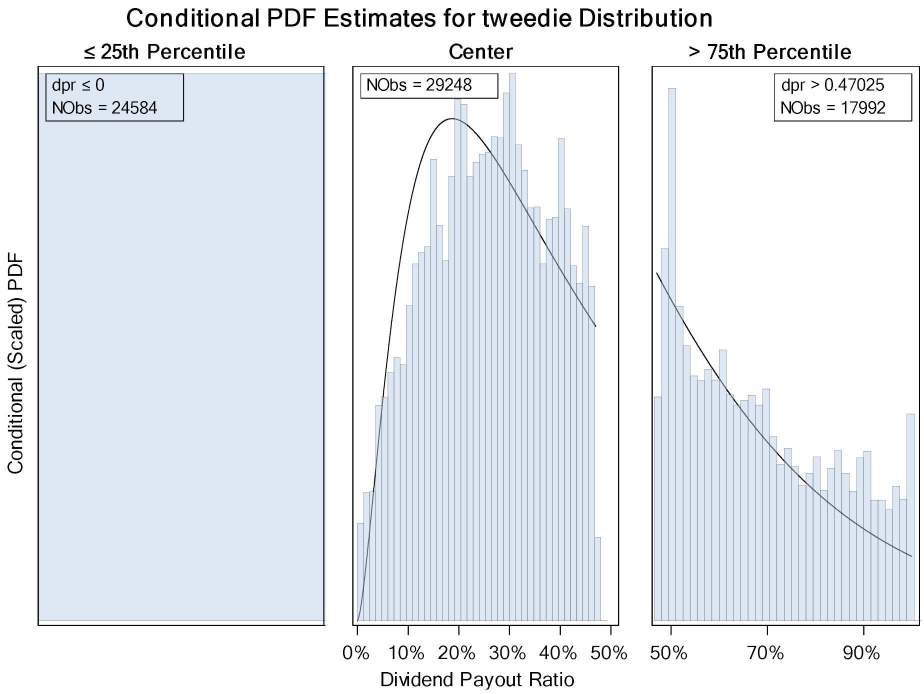


Figure 4: The conditional probability density function estimates for Tweedie distribution against the empirical distribution: Tweedie distribution is a good choice in approximating the real distribution.

The Tweedie distribution has nonnegative support and can have a discrete mass at zero, making it useful to model responses that are a mixture of zeros and positive values, just like the empirical distribution of DPR (see Figures 1-4). Hence, we will describe the behaviour of DPR using the Tweedie distribution.

We estimated the parameters of the Tweedie distribution for the complete database, using numerical method for the maximum likelihood estimator of extra parameter of variance, mean and dispersion parameter. A detailed description of the method is given in Gilchrist and Drinkwater (1999). This method has been implemented in SAS 9.3 and we used the *proc severity procedure* for this. The results of the estimation are presented in Table 5.

Table 5: Parameter Estimates for Tweedie Distribution (entire period 2008-2014)

Parameter	DF	Estimate	Standard Error	t Value	Approx. Pr > |t|
p (extra parameter of variance)	1	1.279	0.002	719.830	<.0001
μ *(mean)*	1	0.277	0.001	235.680	<.0001
ϕ *(dispersion parameter)*	1	0.509	0.003	158.590	<.0001

Source: Own calculation using SAS 9.3

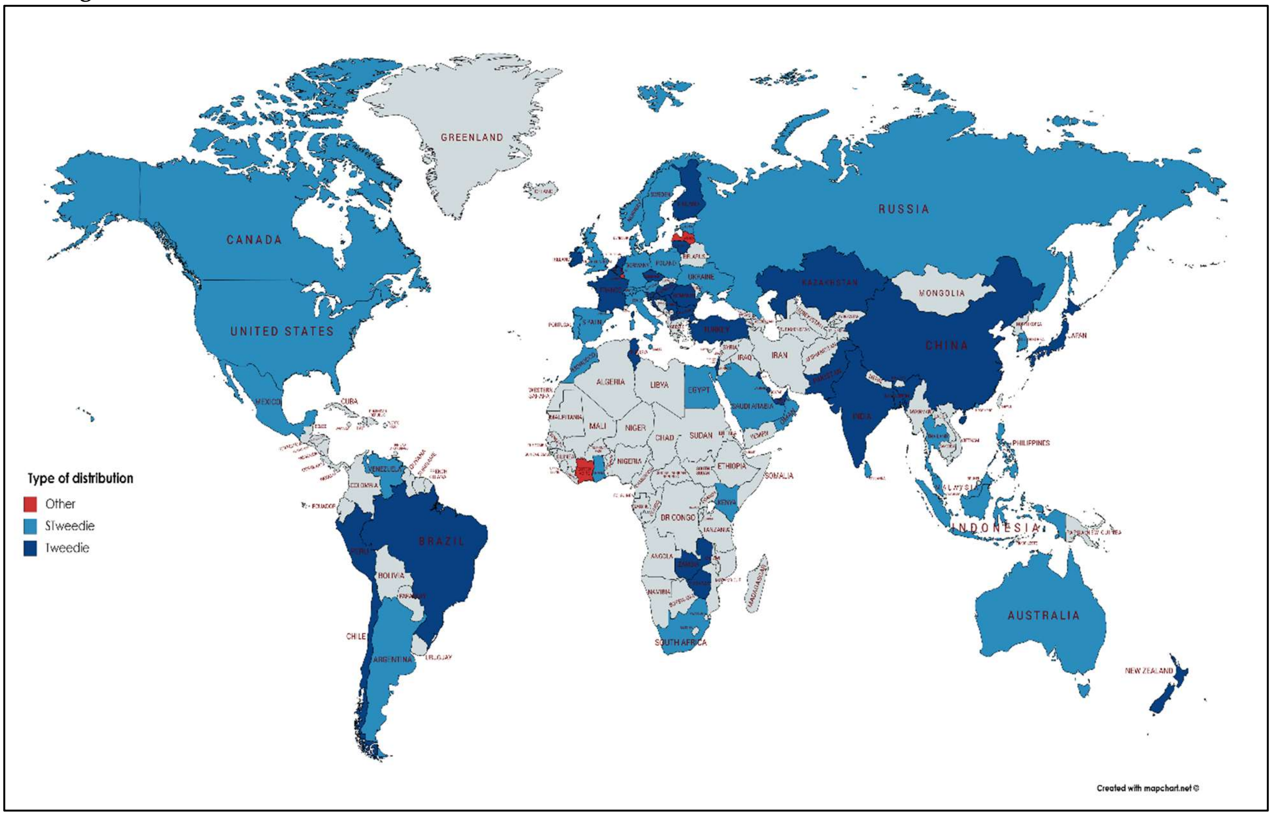
By analysing the parameters of the estimated Tweedie distribution, several conclusions can be drawn. Firstly, the value of extra parameter controlling for variance is significantly different from zero, as would be the case if the payout ratio follows a Gaussian distribution. Moreover, *1<p<2*, so the distribution of dividend payout ratio is in fact a compound Poisson–gamma distribution[14]. A compound Poisson random variable Y is the sum of *N* independent gamma random variables where N follows a Poisson distribution and *N* and the gamma random variates are independent. The distribution of DPR is stable in time, the parameters of the yearly Tweedie distribution being significant and in line with the values estimated for the entire time-period (see Table 6).

Table 6: Parameter Estimates for Tweedie Distribution by year

Parameter	2008	2009	2010	2011	2012	2013	2014
p (extra parameter of variance)	1.252	1.277	1.287	1.292	1.283	1.274	1.271
μ *(mean)*	0.283	0.274	0.275	0.274	0.277	0.276	0.280
ϕ *(dispersion parameter)*	0.466	0.513	0.514	0.538	0.528	0.508	0.465

For the majority of countries in our sample, DPR follows either a Tweedie distribution or a Scaled Tweedie (STweedie) distribution. The exceptions are Côte d'Ivoire, Luxembourg and Latvia. In the map below, the distribution for each country is presented (see Figure 5). In Appendix 4, the estimated parameters of the Tweedie and Scaled Tweedie distribution by country are shown.

Figure 5. DPR distribution across countries



14 This is the most used case in practice, when the Tweedie random variable can be generated from a Poisson gamma distribution (see Smyth 1996).

For most of the countries, the distribution of the Dividend Payout Ratio is either a standard Tweedie or a Scaled Tweedie distribution. This may be a sign of systematic behaviour, regardless of country.

The finding that the Dividend Payout Ratio follows a Tweedie distribution can be have practical applications; for example, one can use the fitted distribution in order to have better estimates of the probability that a certain event will occur (e.g., DPR to be lower or higher than a benchmark).

6 CONCLUSIONS

Dividend policy is still a largely discussed issue in corporate finance literature. For its analysis, dividend payout ratio has certain advantages and is extensively used. Using a database consisting of 12,085 companies operating in 73 countries, for the period 2008-2014, we confirm (in line with Fama and French 2001, Denis and Osobov 2008, von Eije and Megginson 2008, Fatemi and Bildik 2012, Kuo et al. 2013, etc.) that this indicator does not follow a normal distribution, but a zero-inflated one. However, because it is not a 0% / 100% dividend payout ratio policy, an analysis concerned only on the propensity to pay dividends can miss some important information.

The most appropriate distribution for modelling dividend payout ratio is the Tweedie distribution (Tweedie 1984) and its version Scaled Tweedie Distribution (Dunn and Smyth 2005). Thus, a better estimation of the probability that dividend payout ratio is lower or higher than a benchmark can be provided. Also, an analysis of dividend policy, distinctly considering payer versus non-payer companies, can offer additional important information for practitioners and, also, for academics. The use of the average levels of dividend payout ratio can determine misleading results.

Even if our database consists of 12,085 companies operating in 73 countries and covering a crisis and post-crisis period (2008-2014), it considers only 7 years. An extension of the analysis for covering a larger period can be a new direction for study.

ACKNOWLEDGEMENTS

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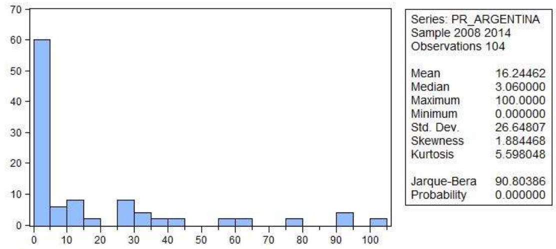
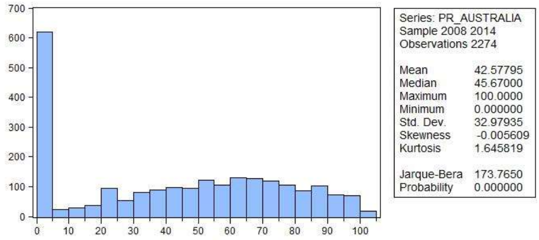
APPENDIXES

Appendix 1: Dividend payout ratio on the world: some descriptive statistics

Country 1 – Argentina



Country 2 – Australia



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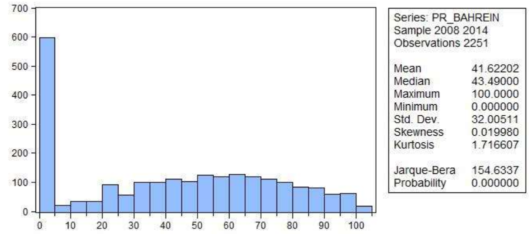
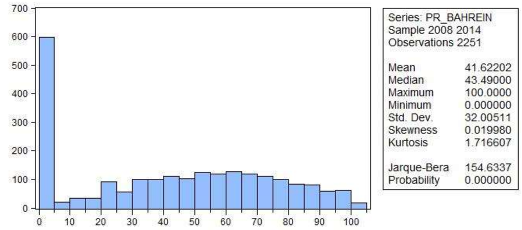
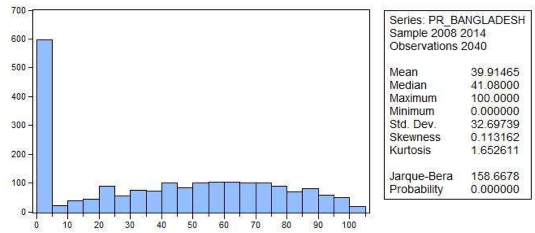


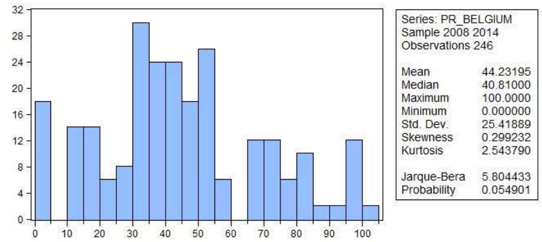
Country 4 – Bahrein



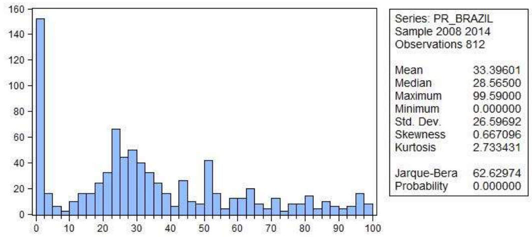
Country 5 – Bangladesh



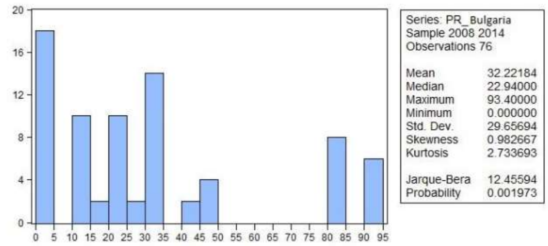
Country 6 – Belgium



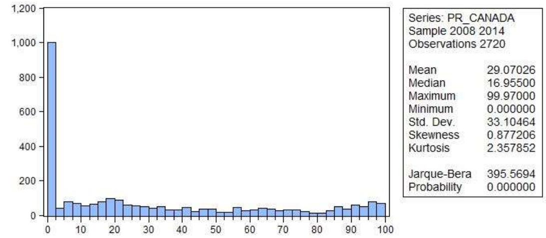
Country 7 – Brazil



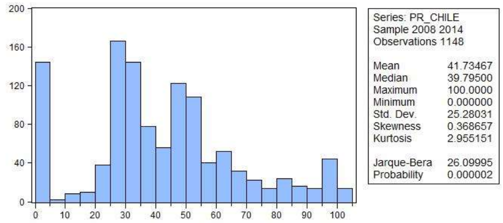
Country 8 – Bulgaria



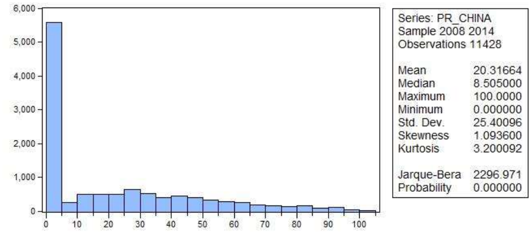
Country 9 – Canada



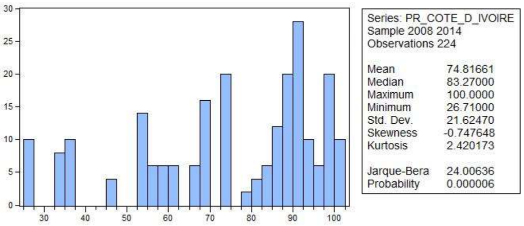
Country 10 – Chile



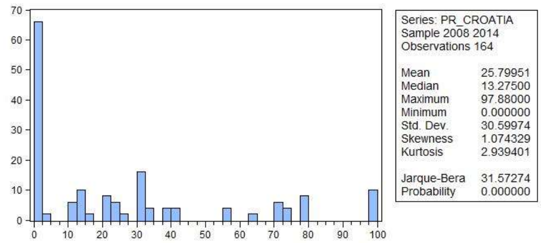
Country 11 – China



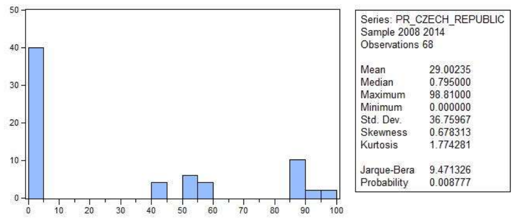
Country 12 - Cote d'Ivoire



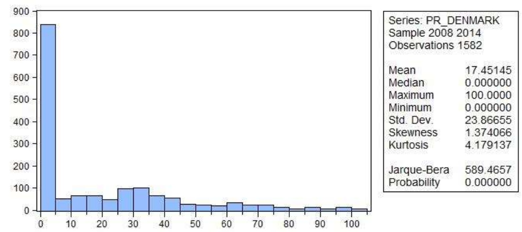
Country 13 – Croatia



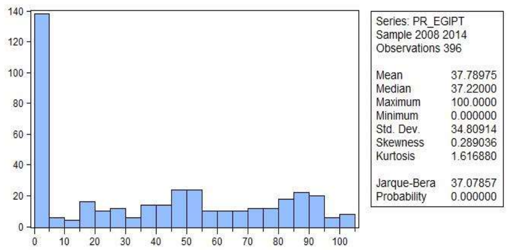
Country 14 – Czech Republic



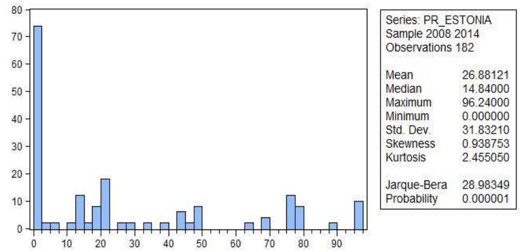
Country 15 – Denmark



Country 16 – Egypt



Country 17 – Estonia



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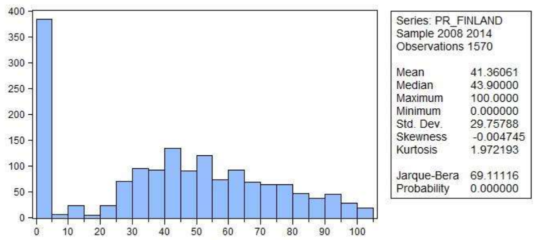
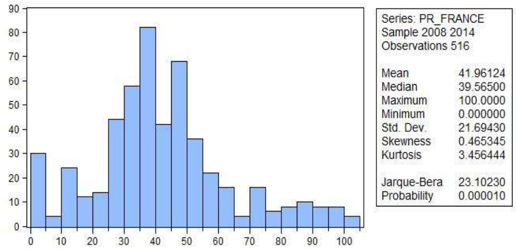
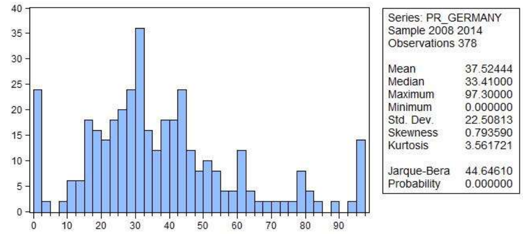


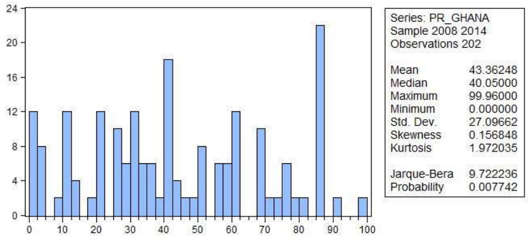
Country 19 – France



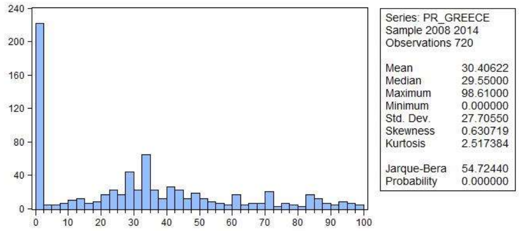
Country 20 – Germany



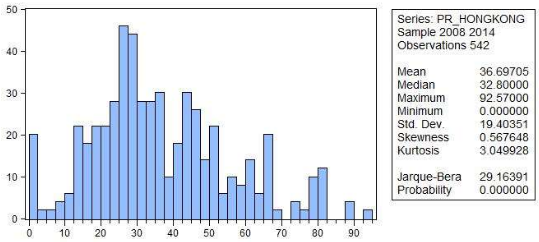
Country 21 – Ghana



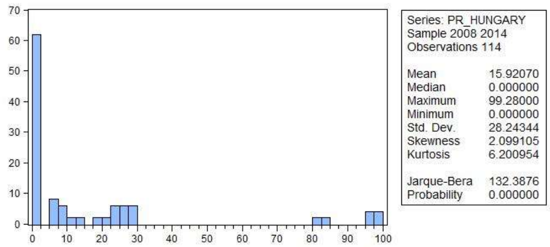
Country 22 – Greece



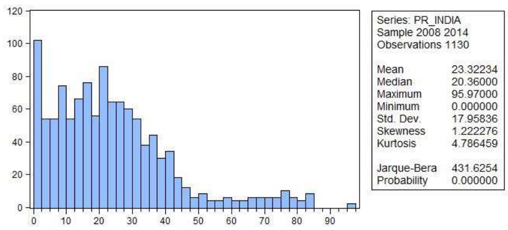
Country 23 – Hong Kong



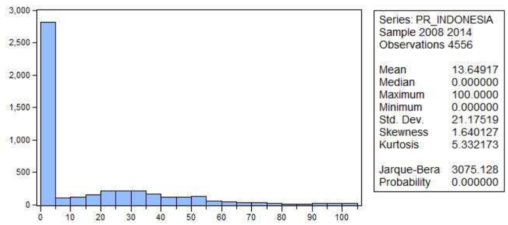
Country 24 – Hungary



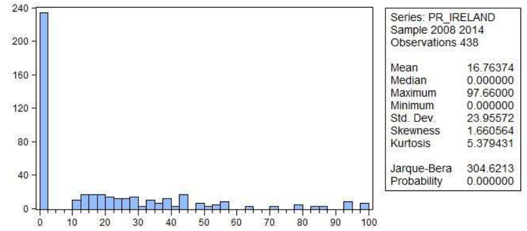
Country 25 – India



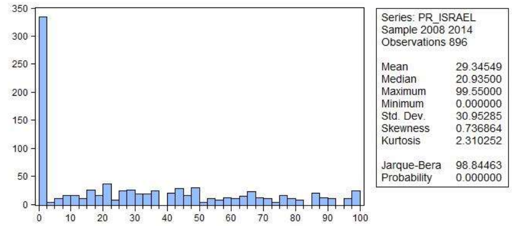
Country 26 – Indonesia



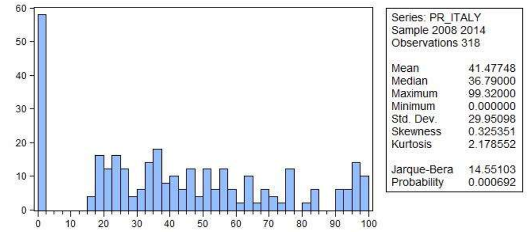
Country 27 – Ireland



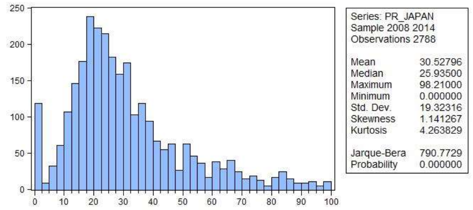
Country 28 – Israel



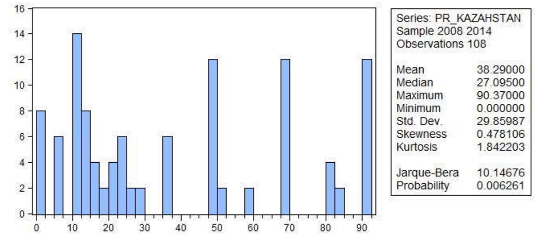
Country 29 – Italy



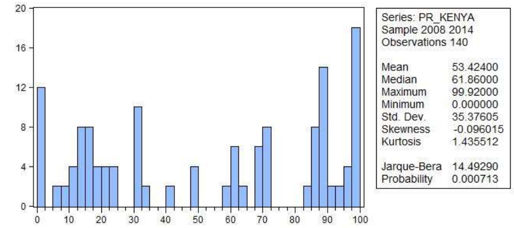
Country 30 – Japan



Country 31 – Kazakhstan



Country 32 – Kenya



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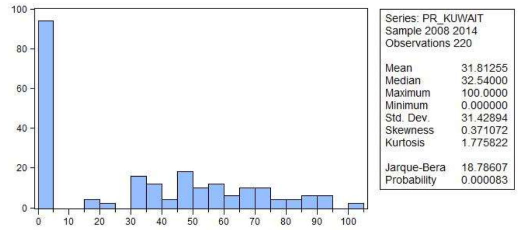
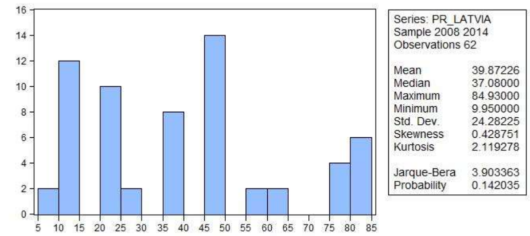
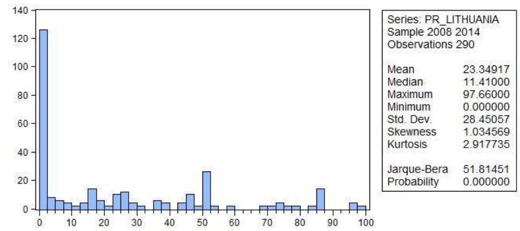


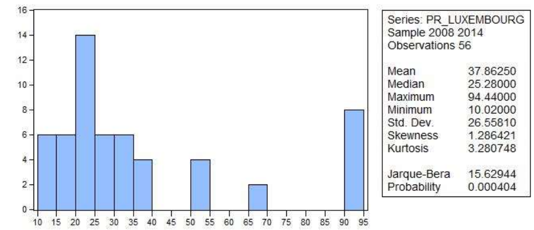
Country 34 – Latvia



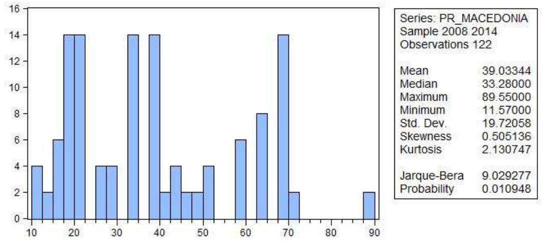
Country 35 – Lithuania



Country 36 - Luxembourg



Country 37 – Former Yugoslav Republic of Macedonia



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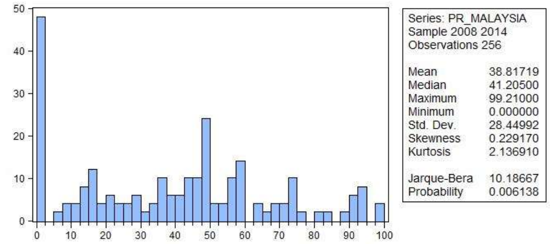

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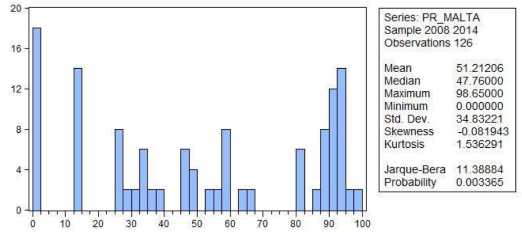
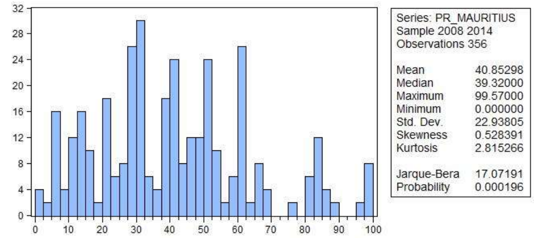
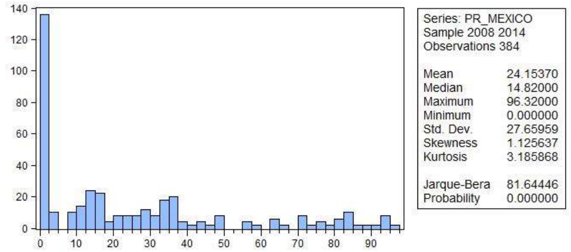


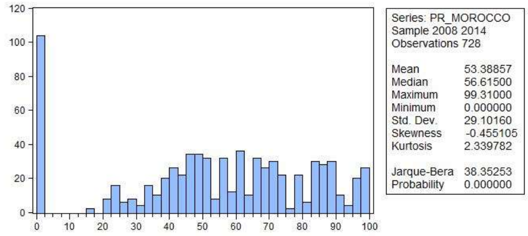
Country 40 – Mauritius



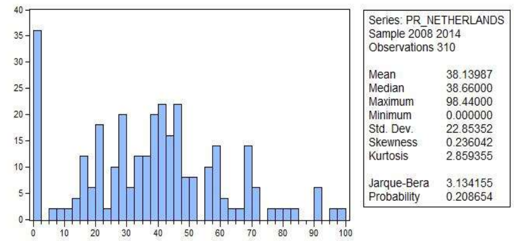
Country 41 – Mexico



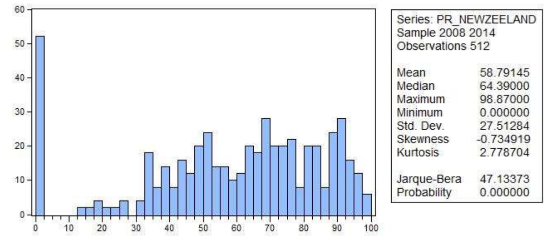
Country 42 – Morocco



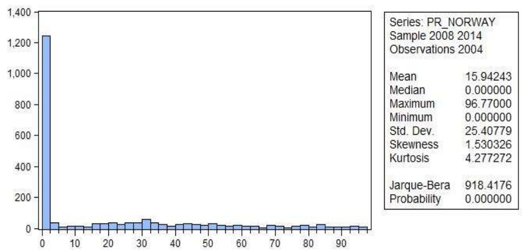
Country 43 – Netherlands



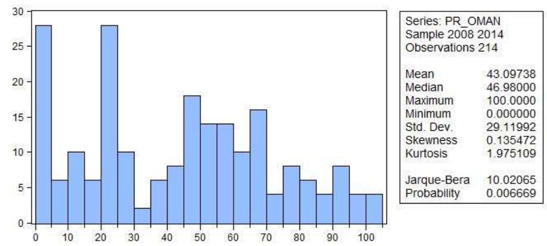
Country 44 - New Zealand



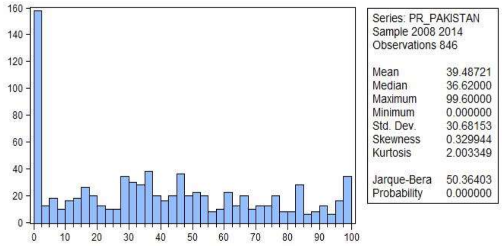
Country 45 – Norway



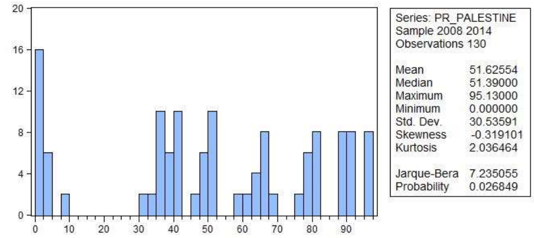
Country 46 – Oman



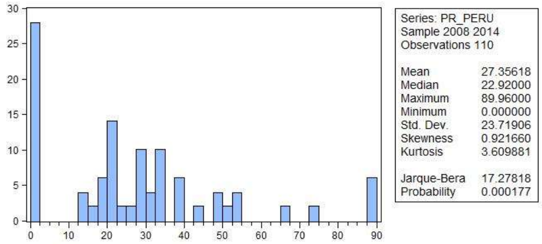
Country 47 – Pakistan



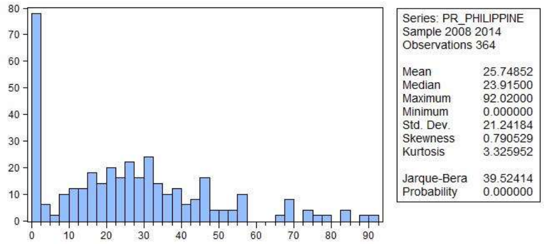
Country 48 – Palestine



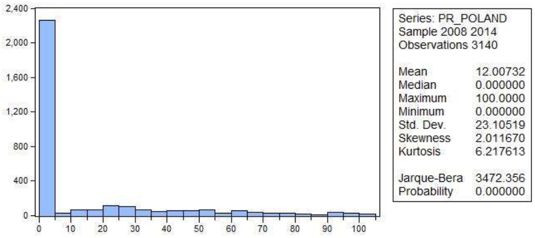
Country 49 – Peru



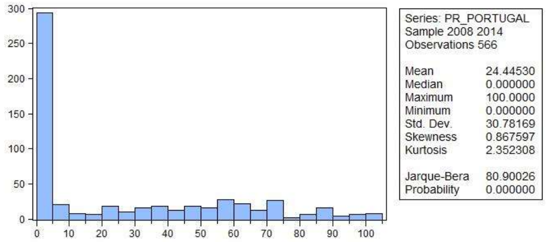
Country 50 – Philippines



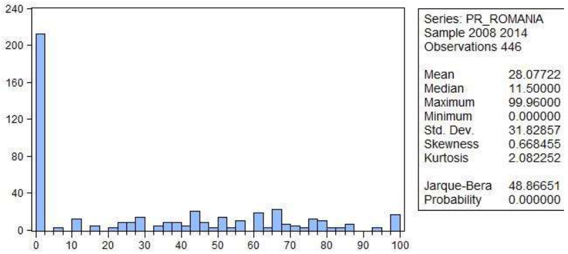
Country 51 – Poland



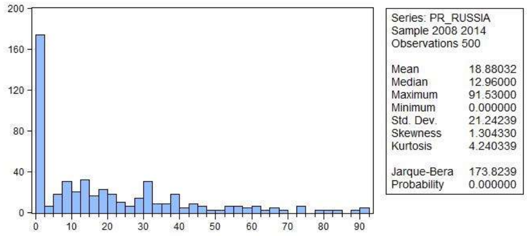
Country 52 - Portugal



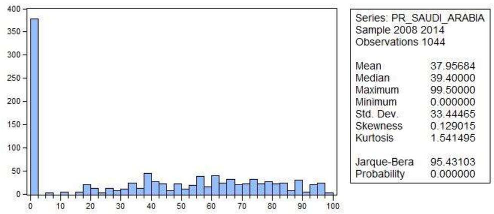
Country 53 - Romania



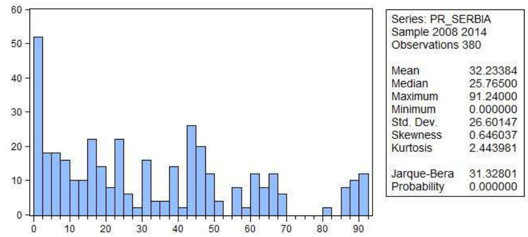
Country 54 – Russia



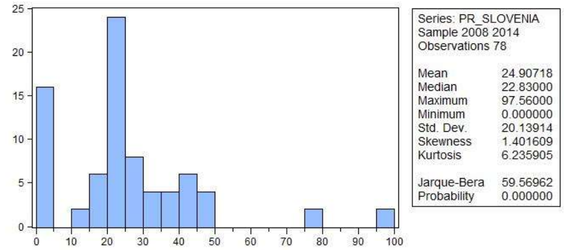
Country 55 – Saudi Arabia



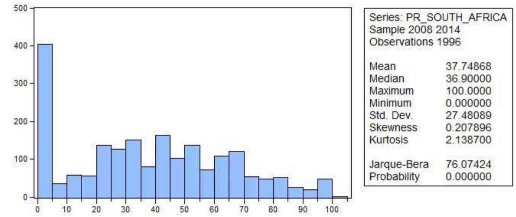
Country 56 – Serbia



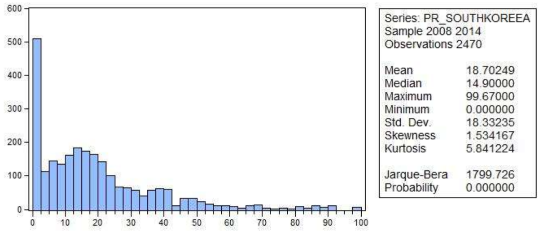
Country 57 – Slovenia



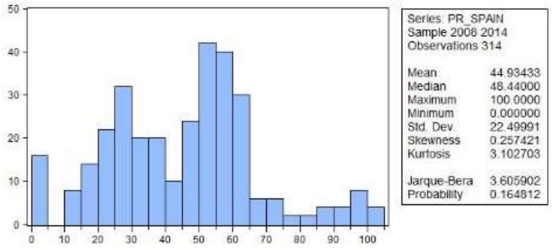
Country 58 - South Africa



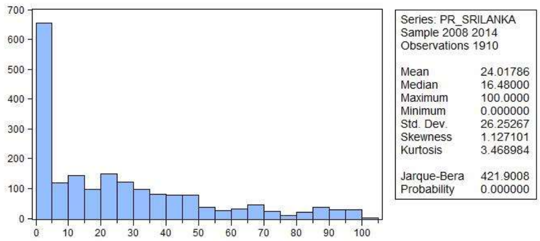
Country 59 - South Korea



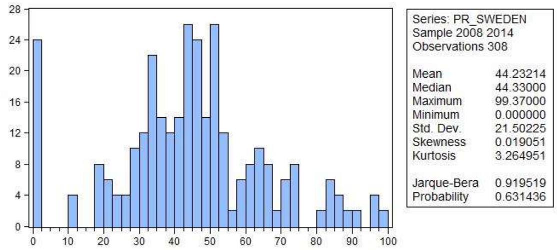
Country 60 – Spain



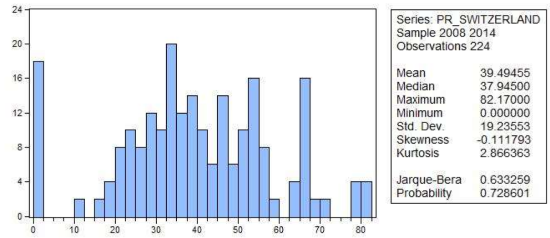
Country 61 - Sri Lanka



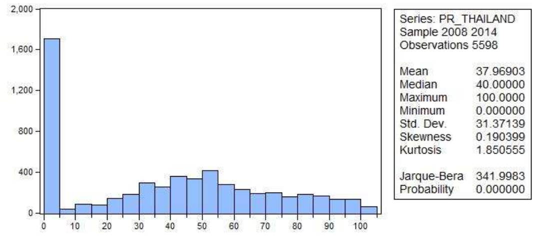
Country 62 – Sweden



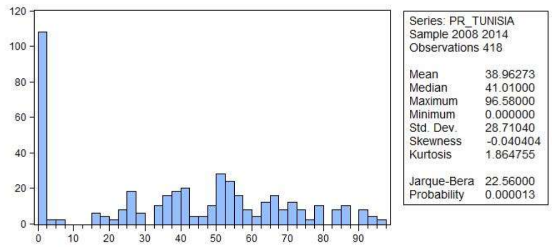
Country 63 - Switzerland



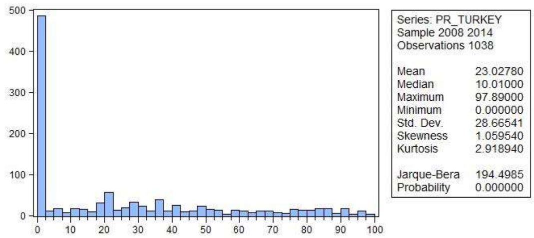
Country 64 – Thailand



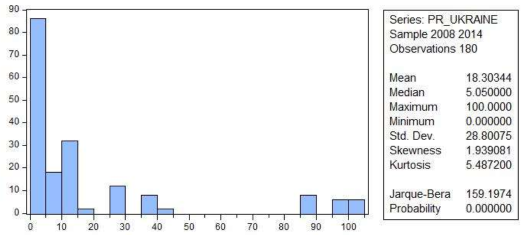
Country 65 – Tunisia



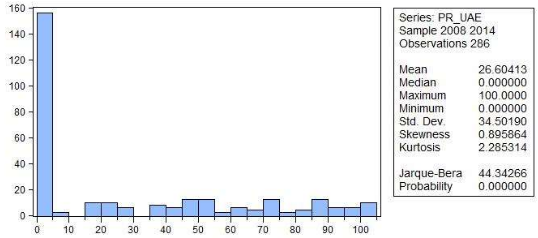
Country 66 – Turkey



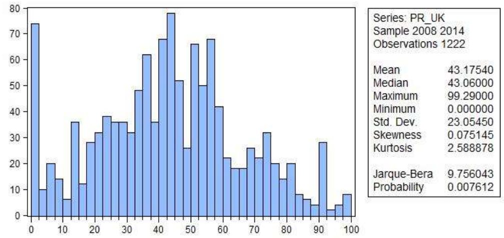
Country 67 – Ukraine



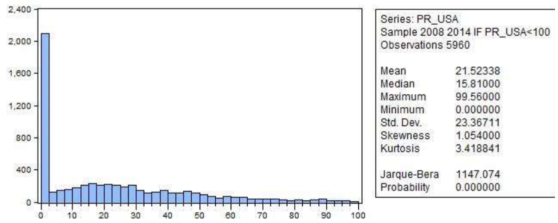
Country 68 - United Arab Emirates



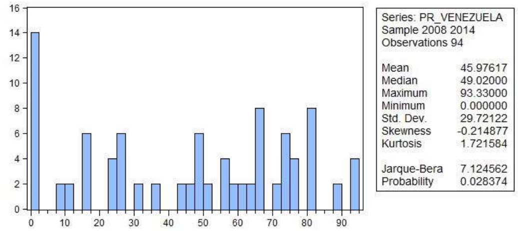
Country 69 - United Kingdom



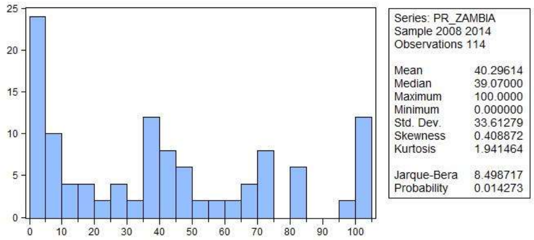
Country 70 - United States of America



Country 71 – Venezuela



Country 72 – Zambia



Country 73 – Zimbabwe

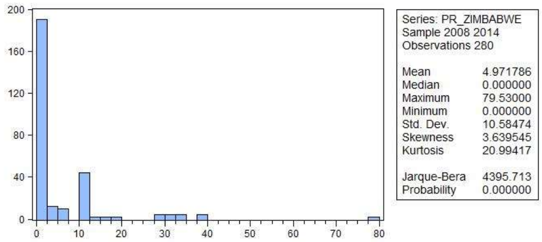


Figure A.1.1: Dividend payout ratio for the companies included in the sample (per country), in the period 2008-2014. All companies' financials were collected from the Thomson Research Worldscope database. DPR is computed as: $DPR = \frac{Dividends}{Net\ income}$.

Appendix 2: Descriptive statistics

Table A2.1: Descriptive statistics

Indicator		**count**	**max**	**average**	**median**	**min**	**Standard deviation**
Dividend Payout Ratio	%	71,814	100.00	27.74	21.84	0.00	28.38

Source: own calculation based on database from Thomson Reuters Worldscope.

Appendix 3: Countries with zero-inflated distributions versus countries with other distributions of Dividend payout ratio

It can be noticed that zero-inflated distribution is not characteristic for all the countries included in our database (approximatively 26% from the total database are in this case) (see Table A.3.1). In some cases, this state is associated with a lower number of observations (e.g., Kazakhstan, Latvia, Luxembourg, Former Yugoslav Republic of Macedonia, Slovenia), but also the zero-inflated distribution appears in cases with a lower number of observations (e.g., Bulgaria, Czech Republic). In addition, it can be noticed that some developed countries, most of them from European Space (Belgium, Luxembourg, France, Germany, Spain, Sweden, Switzerland, UK), but, also, Japan are present in this category.

Table A.3.1.: Countries with zero-inflated distributions versus countries with other distributions of Dividend payout ratio

Zero-inflated distribution	Other distributions
Austria	Belgium
Argentina	Bulgaria
Australia	Chile
Bahrein	Cote d'Ivoire
Bangladesh	Former Yugoslav Republic of Macedonia
Brazil	France
Bulgaria	Germany
Canada	Hong-Kong
China	Japan
Croatia	Kazakhstan
Czech Republic	Kenya
Denmark	Latvia
Egypt	Luxembourg
Estonia	Mauritius
Finland	Slovenia
Greece	Spain
Holland	Sweden
Hungary	Switzerland
India	United Kingdom
Indonesia	
Ireland	

Israel	
Italy	
Kuwait	
Lithuania	
Malaysia	
Malta	
Mexico	
Morocco	
New Zeeland	
Norway	
Pakistan	
Palestine	
Peru	
Philippines	
Poland	
Portugal	
Romania	
Russia	
Saudi Arabia	
Serbia	
South Africa	
South Korea	
Sri Lanka	
Thailand	
Tunisia	
Turkey	
Ukraine	
United Arad Emirates	
United States of America	
Venezuela	
Zambia	
Zimbabwe	

Note: the results for Oman are not conclusive.

It can be suspected that the situation from Table A.3.1. can be related to the capital market development (see market capitalization as proxy). However, from the first 10 countries ranked function of market capitalization[15], four present a zero-inflated distribution (US, China, Canada, India). Considering the value of stocks traded as percent in GDP[16], six present a zero-inflated distribution[17].

One interesting future direction for analysis is to consider some cultural determinants for explaining this zero-inflated distribution for DPR. These similarities can be explained by similar cultural dimensions or people behaviour. For example, similar harmony index (Yaseen and Dragotă, 2019) or similar life standards (Yaseen, 2019) in those countries may lead to similar decisions regarding paying dividends or not.

[15] Top 10 countries, as market capitalization, according to: https://www.indexmundi.com/facts/indicators/CM.MKT.LCAP.CD/rankings, is: 1. US. 2. China. 3. Japan. 4. Hong-Kong. 5. France. 6. Canada. 7. UK. 8. Germany. 9. India. 10. Switzerland.

[16] Top 10 countries, as value of stocks traded as percent in GDP, according to: https://www.indexmundi.com/facts/indicators/CM.MKT.TRAD.GD.ZS/rankings, is: 1. Hong-Kong. 2. US. 3. China. 4. South Africa. 5. Switzerland. 6. South Korea. 7. Japan. 8. Finland. 9. Italy. 10. Iceland.

[17] We did not include in our study Iceland because of lack of data.

Appendix 4: Parameters of the Tweedie and Scaled Tweedie distribution, by country

Table A.4.1 - Estimated Parameters of the Tweedie and Scaled Tweedie distribution, by country

Country	Distribution of DPR (2008-2014)	Theta θ	P p	Mu μ	Phi ϕ	Lambda λ
Côte d'Ivoire	Burr					
Luxembourg	Burr					
Latvia	Exp					
South Africa	STweedie	0.029	1.139			2.150
Argentina	STweedie	0.204	1.478			0.727
Australia	STweedie	0.052	1.143			1.376
Austria	STweedie	0.022	1.063			1.009
Canada	STweedie	0.148	1.344			1.031
Denmark	STweedie	0.105	1.283			0.653
Egypt	STweedie	0.094	1.214			1.094
Switzerland	STweedie	0.004	1.038			3.542
Estonia	STweedie	0.101	1.258			0.928
Germany	STweedie	0.021	1.144			3.000
Ghana	STweedie	0.059	1.297			3.124
Greece	STweedie	0.083	1.248			1.213
Hong Kong	STweedie	0.010	1.099			3.954
Indonesia	STweedie	0.109	1.288			0.502
Italy	STweedie	0.018	1.070			1.699
Kenya	STweedie	0.034	1.140			2.586
Malaysia	STweedie	0.031	1.129			1.868
Malta	STweedie	0.041	1.149			2.219
Mauritius	STweedie	0.022	1.179			3.945
Mexico	STweedie	0.142	1.404			1.156
Morocco	STweedie	0.031	1.120			2.340
Norway	STweedie	0.140	1.295			0.476
Oman	STweedie	0.033	1.139			2.105
Palestine	STweedie	0.071	1.269			2.697
Philippines	STweedie	0.053	1.261			1.711

Country	Distribution of DPR (2008-2014)	Theta θ	P p	Mu μ	Phi ϕ	Lambda λ
Poland	STweedie	0.125	1.259			0.335
Portugal	STweedie	0.145	1.282			0.660
Russian Federation	STweedie	0.112	1.432			1.285
Saudi Arabia	STweedie	0.080	1.172			0.984
Rep. of Korea	STweedie	0.057	1.336			1.662
Spain	STweedie	0.007	1.053			3.594
Sri Lanka	STweedie	0.109	1.356			1.212
Sweden	STweedie	0.003	1.027			4.111
Thailand	STweedie	0.061	1.157			1.161
United States	STweedie	0.212	1.631			1.739
United Kingdom	STweedie	0.021	1.144			3.525
United Kingdom	STweedie	0.094	1.326			1.103
Venezuela	STweedie	0.190	1.537			2.805
Bahrain	Tweedie		1.050	0.430	0.210	
Bangladesh	Tweedie		1.375	0.286	0.600	
Belgium	Tweedie		1.054	0.442	0.181	
Brazil	Tweedie		1.267	0.334	0.351	
Bulgaria	Tweedie		1.703	0.322	0.677	
Czech Republic	Tweedie		1.487	0.290	1.454	
Chile	Tweedie		1.181	0.417	0.238	
China	Tweedie		1.218	0.202	0.507	
Croatia	Tweedie		1.407	0.257	0.742	
Finland	Tweedie		1.144	0.413	0.394	
France	Tweedie		1.095	0.419	0.145	
Hungary	Tweedie		1.408	0.159	0.933	
India	Tweedie		1.268	0.233	0.191	
Ireland	Tweedie		1.160	0.168	0.411	
Israel	Tweedie		1.255	0.293	0.530	
Japan	Tweedie		1.124	0.305	0.133	
Kazakhstan	Tweedie		1.695	0.382	0.593	

Country	Distribution of DPR (2008-2014)	Theta θ	P p	Mu μ	Phi ϕ	Lambda λ
Kuwait	Tweedie		1.083	0.318	0.492	
Lithuania	Tweedie		1.315	0.233	0.641	
FYR of Macedonia	Tweedie		2.639	0.390	0.534	
Netherlands	Tweedie		1.097	0.381	0.203	
New Zealand	Tweedie		1.030	0.587	0.183	
Pakistan	Tweedie		1.234	0.395	0.356	
Peru	Tweedie		1.073	0.274	0.271	
Romania	Tweedie		1.186	0.280	0.607	
Serbia	Tweedie		1.595	0.322	0.516	
Slovenia	Tweedie		1.583	0.249	0.478	
Tunisia	Tweedie		1.136	0.389	0.379	
Turkey	Tweedie		1.325	0.230	0.714	
United Arab Emirates	Tweedie		1.193	0.266	0.708	
Zambia	Tweedie		1.336	0.402	0.447	
Zimbabwe	Tweedie		1.620	0.049	1.828	