

## **STOCK SPLITS AND INPLITS IN BRAZIL, UNITED STATES AND GERMANY: INFLUENCE OVER DIVIDENDS POLICY IN THEIR RESPECTIVES ELECTRIC SECTOR FIRMS**

*DESDOBRAMENTOS E AGRUPAMENTOS DE AÇÕES NO BRASIL, ESTADOS UNIDOS E ALEMANHA: INFLUÊNCIA SOBRE POLÍTICA DE DIVIDENDOS EM SUAS RESPECTIVAS EMPRESAS DO SETOR ELÉTRICO*

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### ***Resumo***

O objetivo deste trabalho é analisar a influência do desdobramento e aglutinação de ações de empresas do setor elétrico do Brasil, Estados Unidos e Alemanha, sobre a política de dividendos e o preço dos ativos. Metodologia: foram coletados dados de pagamentos de dividendos e de valores diários de ações de empresas do setor elétrico do Brasil, Estados Unidos e Alemanha, respectivamente negociados nas Bolsas de valores de São Paulo, New York e Frankfurt. Foi compreendido o período de 01 de janeiro de 2000 até 31 de dezembro de 2022. Resultados: as ações brasileiras sofreram mais desdobramentos que as dos EUA. Não houve diferenças significativas quanto a aglutinações. Quanto aos dividendos e variação de preços de ativos, houve maior pagamento de dividendos nas empresas que não desdobraram no Brasil, ao passo que o contrário ocorreu nos EUA. Não houve diferenças significativas entre aglutinações.

Palavras-chave: desdobramentos de ações; política de dividendos; setor elétrico

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## Abstract

*The aim of this study is to analyze the influence of the split and inplit of shares of companies in the electricity sector in Brazil, the United States and Germany, on dividend policy and asset prices. Methodology: data on dividend payments and daily value of shares of companies in the electricity sector in Brazil, the United States and Germany, respectively traded on the São Paulo, New York and Frankfurt stock exchanges, were collected. The period from January 1, 2000 to December 31, 2022 was covered. Results: Brazilian shares suffered more developments than those in the USA. There were no significant differences regarding agglutinations. Regarding dividends and changes in asset prices, there was a greater payment of dividends in companies that did not split in Brazil, while the opposite occurred in the USA. There were no significant differences between inplits.*

**Keywords:** stock splits; dividend policy; electrical sector

## INTRODUCTION

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A share split is an operation that increases the number of shares in a company. This is matched by a proportional reduction in the nominal price of each share. As a result, the share capital remains unchanged. Under the assumption of the efficient markets hypothesis, splits should not generate any abnormal return. However, research on splits around the world shows the possibility of abnormal return (BAKER et al, 1995; HE; WAN, 2012). In recent years, researchers have become increasingly interested in stock splits, more specifically the market reactions on splits. Stock split is described as the least understood phenomena in stock market, though it has been researched the most (GUO et al, 2008).

Institutional differences between countries have been suggested as responsible for the different

reactions to stock splits in different countries (ANEMOUDIS; MOUSMOULAS, 2015; PIISPANEN, 2021). An example would be Germany, with its minimum par value requirement of the German corporate code (§ 8 Aktiengesetz)”, which states that par value shares must be denominated in Euros at least 1 and that higher nominal share amounts must be expressed in Euros (BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ, 2020).

According to Fama (1969), stock splits affect dividend payments positively. The electricity sector, in turn, is characterized by paying dividends above the average of public companies (SILVA, 2019). The aim of this work is to analyze the influence of the split and merger of shares of companies in the electricity sector in Brazil, the United States and Germany, on dividend policy and asset prices.

The article is divided as follows: this introduction, the theoretical framework, where the themes of dividend taxation and dividend policy in the electricity sector are explored in depth and the hypotheses to be tested are formulated. The methodology and results follow, where the statistical analysis of the collected data and its discussion in light of the literature are demonstrated. The article ends with final considerations, where the results achieved and perspectives for future research are reviewed.

## THEORETICAL REFERENCE

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The events that occur in the stock markets, related to stock splits and reverse stock splits or inplits of shares, are topics commonly discussed by experts who have tried to find evidence that allows the convergence between theories and real data. There is currently no consensus on the possible implications of these events for shareholders' wealth. Whether these effects are

positive or negative, this theme seems to arouse a lot of curiosity, in addition to some criticisms about companies that adopt strategies based on developments and groups (AMORIM, 2017). In theory, the stock split does not affect a company's added market value. However, companies generally split their shares to keep the price in the desired trading range and, perhaps, to make the stock more accessible to individual investors (SMITH, 2019). The relationship between the dividend policy and the stock split, therefore, has been fuzzy, mainly in the information content of both and its influence on the volume traded and on the prices after the split (GRINBLATT et al, 1984; MCNICHOLS; DRAVID, 1990).

There are several theories to explain the phenomenon of stock splits: hypothesis of transaction costs and desired trading range, signaling hypothesis (ASQUITH et al, 1989; RANKINE; STICE, 1997), hypothesis of neglected company (GRINBLATT et al, 1984, ARBEL; SWANSON, 1993; RANKINE; STICE, 1997) and liquidity (BAKER; POWELL, 1993; MUSCARELLA; VETSUYPENS, 1996) and the behavioral hypothesis (WELD et al, 2009; LEITE, 1994). Even for Reverse Stock Splits there is a specific bibliography (WOOLRIDGE; CHAMBERS, 1983; MICHAYLUK, 2009). For a quick review, we suggest Silva and Kirch (2020).

Stock groupings (or Reverse Stock Splits) remain with contradictory results: Woolridge and Chambers (1983) report significantly negative abnormal returns over the announcement period for grouping. Although Peterson and Peterson (1992) find overall negative abnormal returns, they document some positive wealth effects for those companies forced to undergo a grouping. Comiran (2009) did not find abnormal price returns when analyzing the grouping of shares in

the Brazilian market in the period from 1986 to 2007.

In the USA, there are several researches that investigate market reactions on stock splits. One of the foremost researches in this research field is studied by Fama et al (1969). According to authors, there are any abnormal behaviour in the return rates of stock in the months surrounding the split. Their findings indicate positive market reaction on the announcement day of the split and suggest that market is also efficient as the market reacts to new information rapidly and reflects all the new available information on stock prices. Fama et al (1969) argue also that stock splits tend be followed by dividend increases, and related to earlier experiences changes in dividends are not unusual to be announced at the same time with splits.

Other many studies on the USA stock splits such those of Grinblatt et al (1984), Lamoureux and Poon (1987), McNichols and Dravid (1990), Maloney and Mulherin (1992) and Ikenberry et al (1996) have concluded that there is evidence of significant positive abnormal returns around the split announcement day. In particular, Grinblatt et al (1984) found that, in the period from 1967 to 1976, their sample of stocks realized an excess return of 3.44% during the three days (-1, 0, +1) surrounding stock split announcements. Ikenberry et al (1996) examined 1,275 two-for-one stock splits announced by NYSE and Amex firms from 1975 through 1990 and observed excess returns of 7.93% in the first year after a stock split and 12.15% in the first three years following a split. These gains were preceded by excess returns of 3.38% on the announcement date (KUNZ; ROSA-MAJHENSEK, 2008). Grinblatt et al (1984) have also observed that "the positive stock price reaction on the announcement day follows a significant positive price run-up in the months preceding the stock split decision.

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Ikenberry et al (1996) proved that this price runup is followed by a persistent upward price drift, which they attributed to investors' underreaction at the announcement time" (LELEDAKIS et al, 2009). Moreover, evidence of significant positive abnormal price reaction was also found around the ex-day of the splits. This was observed by many researchers, such as Eades et al (1984), Grinblatt et al (1984), Lamoureux and Poon (1987) and Maloney and Mulherin (1992). According to Leledakis et al (2009): "Lamoureux and Poon (1987) attributed the positive market reaction to price pressure induced by an expansion of the investor clientele of the splitting stocks which generates additional positive revaluation around the ex-day, while Maloney and Mulherin (1992) provided evidence that the ex-day positive price reaction was a result of a temporary order imbalance caused by a surge of buy orders as new investors are attracted to the splitting stock" (LELEDAKIS et al, 2009).

Lakonishok and Lev (1987) concluded that splits might affect the composition of shareholders, in form of a shift from institutional to individual investors, Szewczyk and Tsetsekos (1993) reported that institutional ownership increases after a split (BLEY, 2002). The main difference between stock splits in Germany and the USA is largely in the fundamental role of the par value of German stocks. Most stocks issued by a USA corporation have a par value, but they do not need to have one. Usually the par value of a USA company is very low and its main privilege is that it does not prevent the company from deciding on a stock split or choosing a convenient split factor.

The scope for German companies to split their stock is limited by the minimum par value requirement of the German corporate code (§ 8 Aktiengesetz)", which states that par value shares must be denominated in Euros at least 1 and that

higher nominal share amounts must be expressed in Euros. "Once a company's stock is traded at the minimum par value, no further splits are possible. In 1994 the minimum par value was lowered from 50 DM to 5 DM, triggering a wave of stock splits. A similar wave of stock splits had occurred when in 1966 the minimum par value was lowered from 100 DM to 50 DM." (ANEMOUDIS; MOUSMOULAS, 2015). Furthermore, "only certain other par values were allowed above the minimum par value, while before 1994, the range of possible higher par values was restricted to multiples of 100 DM and in 1994 it changed to multiples of the new minimum par value of 5 DM (ANEMOUDIS; MOUSMOULAS, 2015). In the years before each corporate law reform act, almost all stocks were traded at the prevailing minimum par value and although after the corporate code reform act of 1994 companies could have decided on a new par value below 50 DM but above 5 DM such as 10 DM or 15 DM, none has chosen to do so and all have split their stock to the lowest possible par value of 5 DM. In 1994, the number of stock splits increased immediately after the change in legislation." (WULFF, 2002). The idea of this regulatory reform in 1994 was to improve the attractiveness of German stocks, especially to strengthen the position in international capital markets (BLEY, 2002). For the stock splits, this led to increasing number of splits (WULFF, 2002). However, companies can have no-par value shares and par value shares. Par value shares must today have a value of at least one euro and non-par value shares represent equal portions of the share capital, which the portion allocated for individual share cannot be lower than one euro. In conclusion, par value shares and non-par value shares are regulated equally, and may restrict companies from splitting stocks (BUNDESMINISTERIUM DER JUSTIZ UND FÜR VERBRAUCHERSCHUTZ, 2020). Further splits are

not possible, once the stock is traded at the minimum par value (WULFF, 2002).

Both Wulff (1996) and Kaserer and Mohl (1998) examined stock splits for the period 1994-1995 and found cumulative abnormal returns of about 1% in a three-day announcement period from  $t(0)$  to  $t(+2)$ . For larger event windows, Wulff (1996) reported positive, even though small, cumulative abnormal returns, but Kaserer and Mohl (1998) observed a reversal of the positive announcement effect by negative abnormal returns in surrounding days. Wulff (1996) reported an ex-day effect, while Kaserer and Mohl (1998) provided mixed evidence. They found a cumulative abnormal return of  $-0.19\%$  for the event window  $[0; +5]$  which contrasts with the positive cumulative returns of  $1.11\%$  and  $1.18\%$  in the event windows  $[-5; 0]$  and  $[-5; +5]$ , respectively. Nevertheless, due to the small sample size, the results of both papers must be treated with caution (ANEMOUDIS; MOUSMOULAS, 2015).

Bley (2002) researches stock splits with smaller sample in German market during 1994–1996. The study includes only 10:1 splits after a legislative initiative in 1994 to improve the attractiveness of German stock market over international investors. The study was executed with the event study methodology and splits were divided into two groups by market capitalization. Bley (2002) reports decrease in daily trading volume for high market capitalization stocks and suggests inverse correlation between the change in trading volume and firm size. Unlike Wulff (2002), Bley (2002) was unable to find any significant abnormal returns around the announcement day to imply positive market reaction on splits. Andres et al (2013) instead research market reaction on dividend announcements in German market. They found significant share price reactions after the dividend announcements and evidence to

support dividend clientele effects. (ANDRES et al, 2013) As the split can be seen as an alternative for dividends, the market reaction could be expected to be positive on splits as well. Wulff (2002) argues that unlike stock splits, dividends can reduce the financial flexibility of a company and suggests that the signaling content of a German dividend announcement should be higher than that of a split announcement.

Piispanen (2021) researched the short-term stock price reaction on stock splits in German market. Data used in the study consisted of 57 splits announced by 49 companies from January 2000 to December 2019. On the split execution day, results showed that splits generated abnormal returns: significant  $1.5\%$   $[-1, +1]$  cumulative average abnormal return was found for total sample in this study which implies considerable high stock price reaction on the split execution day. Findings showed that the selected split ratio by the company had statistically significant impact on abnormal returns on the split execution day as well. Results for 3:1 splits showed considerable high abnormal returns on the event day and each pre-event period compared to 2:1 splits, implying that higher split ratios appear to generate higher abnormal returns. The results obtained showed that the benefit of splits seem to be quite short-lived as abnormal returns reduce quickly after the split execution day.

Anemoudis and Mousmoulas (2015) employed a sample of German companies that announced a stock split during the years 2008 and 2009, a period which signals the beginning of the economic crisis. The main objective the study was verify the impact of stock split announcements on stock prices. The results were not consistent with the findings in other capital markets, including the USA, as no evidence of positive price reaction is observed around the announcement day of

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German stock splits. The results were not in line with many other studies on stock splits in different capital markets and no evidence of significant positive market reaction around the stock split announcement day is found. As a result, stock split announcements of German firms do not bring about significant stock price appreciations to investors in this particular period examined. Institutional differences between Germany and other capital markets allow the examination of one of the main hypothesis on the announcement effect, which is the signaling hypothesis. The authors argue that legal restrictions strongly limit the ability of German companies to use a stock split for signaling and that stock price reactions are not related to future earnings.

In Brazil, Vieira and Procianoy (2003), studied the shares of public companies traded on BOVESPA that announced and executed stock splits and / or stock dividends from January 1987 to May 1997, totaling 685 events. Its results suggest that provides an increase in the amount of business; but as there is a decrease in the number of shares involved in each trade, the financial volume traded does not reach the same proportions prior to the split. In addition, the results reveal that, based on publicly available information, investors achieved higher than expected returns, contrary to what would be expected, which suggests a market inefficiency, in the semi-strong form. It can be conjectured that, despite being publicly advised, not all investors would be aware of the new share value after the event, thus allowing well-informed investors to obtain extra returns. For administrators, only the notion of prices and the volatility of returns are relevant to the definition of the split factor (VIEIRA; BECKER, 2011).

Also in Brazil, Antônio et al (2018), from a database of 11,317 events using the methodology

of the study of events with a 15-day window pre and post event, based on Bootstrap (statistical technique that performs simulations to verify which is the best distribution in which the sample fits), showed that the event that was able to influence positively the market was the disclosure of stock splits, since on the day of the event the average abnormal return of the shares was 1.96%. Splits usually lead to greater liquidity for shares in the market with a reduction in the prices of these papers. In addition, despite the fact that the groups of shares do not present abnormal statistically significant returns, the authors inferred that the return on shares around this event follows a downward trend, indicating a negative signal to the market.

Leite (1994), based on data from the São Paulo Stock Exchange, concluded that the hypothesis whose part of investors may have, in relation to splits, some kind of "monetary illusion", making them feel "richer" because they would have more shares, in a behavior as according to classic texts, would be totally irrational. Unquestionably, there is a flagrant inefficiency within the semi-strong concept: the market reacts positively to an event that, in addition to being publicly known, has been expected for some time. The inefficiency transcends the hypothesis of irrationality: even if the existence of informational content in the split is considered, its prices should react promptly, as soon as its announcement was made, which did not happen as according to Leite (1994) study.

The electricity sector is characterized by paying dividends above the average of public companies (SILVA, 2019). The studies on dividend policy in Brazil need some specific care, since the tax system on dividends differs from that adopted in the countries of origin of the most relevant studies on the subject, such as the USA, England, Germany and Japan (FORTI et al, 2015). The electricity sector, not only because it is classified

as part of the public concession sectors that makes it different from other sectors of the economy, but, due to its specific form of regulation, places it on a different level. According to Bernardino et al (2015), this sector is regulated and subordinated to public policies related to price, contribution margin and returns. In the Brazilian case, its regulatory structure resulting from the time of privatizations that occurred in the 1990s creates, in a sector already full of challenges, very important issues, such as the dividend policy (SILVA; KIRCH, 2019) and stock splits policy (SILVA; KIRCH, 2020).

Silva and Kirch (2020), researched the developments of actions in Brazil regarding the electricity sector. Despite the small sample, some conclusions were drawn: 1) the split/grouping was related to the increase in traded volume on the first day after its occurrence, which could demonstrate the informational content; 2) the turnover of shares due to the split/regrouping was greater on the first day and in the third month after the split; 3) the price of the split shares increased relative to the control group in the first week after the split/regroup; 4) no significant relationship was found in the linear regression between the share price and its respective volume and the share turnover in any of the groups; 5) the split did not influence the yield in the first 3 years after the split. The yield level between the groups (split and non-split) was not statistically different; 6) linear regression showed no statistical correlation between income and stock prices.

Given the above, the following hypotheses were formulated:

HA1: countries differ in terms of the amounts of splits and aggregation of shares (ANEMOUDIS; MOUSMOULAS, 2015; PIISPANEN, 2021).

HB1: there are differences in the amount of dividends paid and share price variation between companies that carried out share splits and mergers and those that did not, according to Lakonishok and Lev (1987) and Dyl and Elliot (2006).

## METHODOLOGY

From the Yahoo Finance website (YAHOO FINANCE, 2023), data was collected on dividend payments and daily values of shares of companies in the electricity sector in Brazil, the United States and Germany, respectively traded on the São Paulo, New York and Frankfurt. The values corresponded to the closing of the daily trading session. The period from January 1, 2000 to December 31, 2022 was covered. Furthermore, data analysis also included data on the GDP of the countries under study and the main indexes of each exchange: in Brazil, the Ibovespa, in USA, the S&P500 and in Germany, the GDAXI.

To test the hypotheses, the collected data were converted as follows: dividends were converted into yield, annual yield variation (hereinafter  $D\_yield$ ), annual dividend payment variation (hereinafter  $D\_div$ ), dividend payment ( $div$ ), represented in Reals, US Dollars or Euros (respectively for the Brazil, USA and Germany groups), and the first yield difference between  $D1$  and  $D0$  (hereinafter  $yi\_d1-d0$ ).

The prices were converted into annual price variation, where the closing value of the asset on the last day of the year was collected in relation to the previous year's value (hereinafter  $D\_price$ ) and also through the difference between  $D\_price$  and the annual variation of the stock index. respective country (hereinafter  $PR\_SP$ ), following the work of Sekula (2023), which showed the influence of the market on earnings on stock

splits, where weaker markets were related to lower earnings. Companies where there was only one year of data were excluded, which would make the conversion to the variables described above unfeasible.

The sample was also divided into the split group, that is, those whose shares underwent an increase in quantity, without being bonuses. In addition, the group of aggregates was also created, that is, shares whose quantity was reduced. The data were analyzed using the chi-square test between the three countries, to test HA and using the Student's t test to test HB. The level of statistical significance was set at 0.1.

## RESULTS

On the São Paulo stock exchange (B3), 17 companies were found, for a total of 184 company-years. The stock exchange From the New York Stock Exchange, 35 companies were found, but Eletrobras was discarded, as it is a company already traded on B3. Thus, through 34 companies, there were a total of 651 company-years. On the Frankfurt Stock Exchange, 3 publicly traded companies were found, representing 69 company-years.

Table 1 shows the amounts of splits and inplits in the different countries and their respective proportions in relation to the total. The largest number of stock splits and inplits occurred in Brazil, while in Germany there were no stock

splits during the period under study. The analysis between countries, using the chi-square test, is in table 2, where the only statistically significant result was the greater number of stock splits in Brazil compared to the USA.

In Brazil, two cases of developments occurred in the same company (CMIG4) and in the same year (2013). Coincidentally, one of the two cases of agglutination occurred with this same company in 2020. A similar case occurred in the US group, where the DUK share suffered two episodes of agglutination (2001 and 2007) and in 2012 promoted a share split. While the largest number of share agglutinations occurred in the US group, the largest agglutinations occurred in the group from Brazil and Germany. In the first, one of the agglutinations was 40 shares transformed into one unit, while in the second, there was an agglutination of 3 units into one.

The descriptive statistics of the different groups in relation to splits are shown in tables 3 to 7. The Student t-test carried out within the groups in relation to splits is in table 8. With statistical significance, in the Brazil group the yield corrected by the difference in relation to the year anterior was greater in non-split shares group. The opposite was seen in the US group, where split shares paid higher dividends. Regarding dividends and changes in asset prices, there was a greater payment of dividends in companies that did not split in Brazil, while the opposite occurred in the USA, which is in accordance with HB1 and the results of Lakonishok and Lev (1987) for the

Table 1 – Stocks Splits and Inplits in Respective Countries

	Stock splits (%)	Stocks inplits (%)	Total (%)
Brazil	5 (2.7)	2 (1.1)	184 (100)
Germany	0 (0)	1 (1.4)	69 (100)
USA	2 (0.3)	13 (2)	651 (100)



Table 2 - Chi-square test of stock splits and inplits

Countries	Stock Splits	Stocks Inplits
Brazil vs USA	Brazil deployed 9 times more than the USA*	USA gathered 1.8 times more than Brazil
Brazil vs Germany	Brazil deployed more than Germany	Germany gathered 30% more than Brazil
USA vs Germany	USA deployed more than Germany	USA gathered 45% more than Germany

\*:  $p < 0.01$

US group, but not for Brazil. However, the results of the Brazilian group regarding price variation, which was equal between the split and non-split groups, are in line with Silva and Kirch (2020) when analyzing a period of time longer than 3 months. The higher yield payment in the Brazilian group due to non-split assets is not only in disagreement with Silva and Kirch (2020), who found no differences, but also with Fama's own work (1969), which showed that splitting leads to an increase in payment of dividends.

The descriptive statistics of the different groups in relation to inplits are in tables 9 to 14. The Student t-test carried out within the groups in relation to agglutination is in table 15. The Germany group cannot be analyzed given the low sample of agglutinated shares ( $n = 1$ ), which returns to the sampling problems also faced by Wulff (2002). No statistically significant difference was found in the other groups, which is in line with Comiran (2009) for the Brazilian market.

Returning, Brazilian shares suffered more splits than those in the USA, which is in line with HA1.

Regarding dividends and changes in asset prices, there was a greater payment of dividends in companies that did not split in Brazil, while the opposite occurred in the USA, which is in accordance with HB1 and the results of Lakonishok and Lev (1987) for the US group, but not for Brazil. However, the results of the Brazilian group regarding price variation, which was equal between the split and non-split groups, are in line with Silva and Kirch (2020) when analyzing a period of time longer than 3 months. The higher yield payment in the Brazilian group due to non-split assets is not only in disagreement with Silva and Kirch (2020), who found no differences, but also with Fama's own work (1969), which showed that splitting leads to an increase in payment of dividends. There were no significant differences between agglutinations, which is in accordance with Comiran (2009) for the Brazilian market. Due to the low sampling of developments and the absence of agglutinations, Germany's stocks could not be analyzed.

Table 3 – Split Brazilian shares (n = 5)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.108 ± 0.027	0.037	0.058	0.127	0.139	0.18
d_yield	0.967 ± 0.943	-0.894	-0.697	-0.071	3.067	3.428
div	1.716 ± 0.688	0.431	0.496	1.511	1.925	4.216
d_div	-0.069 ± 0.427	-0.827	-0.681	-0.39	0.015	1.54
yi_d1-d0	-0.07 ± 0.112	-0.49	-0.085	-0.01	0.096	0.14
D_preco	0.091 ± 0.123	-0.097	-0.085	-0.07	0.162	0.546
Pr-sp	-0.064 ± 0.117	-0.459	-0.17	0.012	0.07	0.227

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Reais); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 4 – Unsplit Brazilian shares (n = 179)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.06 ± 0.005	0	0.016	0.043	0.089	0.548
d_yield	47.45 ± 39.61	-1	-0.517	0.039	0.635	7089.66
div	1.56 ± 0.22	0	0.1815	0.97	1.963	28.86
d_div	33.11 ± 27.45	-1	-0.5	0.03	0.83	4914.25
yi_d1-d0	0.004 ± 0.004	-0.169	-0.023	0.0008	0.025	0.342
D_preco	0.062 ± 0.029	-0.803	-0.123	0.018	0.202	2.334
Pr-sp	-0.008 ± 0.029	-1.029	-0.204	-0.011	0.174	2.456

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Reais); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 5 – Split USA Stocks (n = 2)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.046 ± 0.001	0.045	0.046	0.046	0.047	0.048
d_yield	-0.052 ± 0.054	-0.106	-0.079	-0.052	-0.025	0.002
div	2.97 ± 0.06	2.909	2.939	2.97	3	3.03
d_div	-0.044 ± 0.064	-0.108	-0.076	-0.044	-0.012	0.02
yi_d1-d0	-0.006 ± 0.003	-0.006	-0.006	-0.006	-0.006	-0.006
D_preco	0.059 ± 0.135	-0.076	-0.009	0.059	0.126	0.194
Pr-sp	-0.105 ± 0.165	-0.27	-0.188	-0.105	-0.023	0.06

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in American Dollars); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 6 – Unsplit USA Stocks (n = 649)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.04 ± 0.001	0	0.031	0.039	0.047	0.179
d_yield	0.001 ± 0.011	-1	-0.102	-0.025	0.07	2.958
div	1.55 ± 0.039	0	0.893	1.44	2.12	6.579
d_div	0.048 ± 0.015	-1	0	0.039	0.07	6.821
yi_d1-d0	-0.0004 ± 0.0006	-0.118	-0.004	-0.0005	0.002	0.151
D_preco	0.066 ± 0.01	-0.818	-0.058	0.068	0.185	1.595
Pr-sp	-4.1E-05 ± 0.01	-1.057	-0.142	-0.0149	0.115	1.3

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in American Dollars); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 7 – Unsplit German shares (n = 69)

	Mean ± standard error	minimum	pc 25	mediana	pc 75	maximum
yield	0.035 ± 0.003	0	0.02	0.032	0.05	0.093
d_yield	0.1425 ± 0.117	-1	-0.239	0.005	0.294	7.144
div	1.019 ± 0.108	0	0.5	0.783	1.416	3.948
d_div	0.21 ± 0.177	-1	-0.207	0	0.169	11.5
yi_d1-d0	0.001 ± 0.002	-0.055	-0.01	0.0003	0.014	0.05
D_preco	0.045 ± 0.033	-0.543	-0.155	0.028	0.264	0.729
Pr-sp	-0.019 ± 0.03	-0.639	-0.149	-0.015	0.2	0.475

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Euros); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 8 - Split vs Unsplit shares Student t-test

	Brazil	USA	Germany
yield	NS	NS	NA
d_yield	NS	NS	NA
div	NS	Desd > ND*	NA
d_div	NS	NS	NA
yi_d1-d0	ND > Desd*	NS	NA
D_preco	NS	NS	NA
Pr-sp	NS	NS	NA

Abbreviations: D\_yield: annual yield variation; Div: dividends paid; D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; \*: p < 0.1; NS: non-significant difference; Desd: split shares; ND: shares not split; Since: split shares; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 9 – Agglutinated Brazilian shares (n = 2)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.015 ± 0.106	0	0.015	0.029	0.169	0.309
d_yield	-0.718 ± 0.282	-1	-0.859	-0.718	-0.577	-0.436
div	0.165 ± 0.165	0	0.082	0.165	0.247	0.329
d_div	-0.773 ± 0.227	-1	-0.886	-0.773	-0.659	-0.546
yi_d1-d0	-0.023 ± 0.011	-0.023	-0.023	-0.023	-0.023	-0.023
D_preco	0.134 ± 0.074	0.059	0.096	0.134	0.171	0.208
Pr-sp	-0.075 ± 0.106	-0.181	-0.128	-0.075	-0.023	0.03

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Reais); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 10 – Unagglutinated Brazilian shares (n = 182)

	Mean ± standard error	minimum	pc 25	median	pc 75	maximum
yield	0.062 ± 0.005	0	0.016	0.047	0.091	0.548
d_yield	46.88 ± 39.06	-1	-0.524	0.052	0.706	7089.66
div	1.583 ± 0.218	0	0.202	0.986	1.967	28.86
d_div	32.7 ± 27.075	-1	-0.5	0.03	0.833	4914.25
yi_d1-d0	0.002 ± 0.005	-0.49	-0.024	0.001	0.026	0.342
D_preco	0.062 ± 0.028	-0.803	-0.123	0.011	0.199	2.334
Pr-sp	-0.005 ± 0.028	-1.029	-0.201	-0.011	0.176	2.456

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Reais); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 11 - Agglutinated USA shares (n = 13)

	Mean ± standard error	mínimo	pc 25	median	pc 75	máximo
yield	0.04 ± 0.004	0.025	0.031	0.034	0.043	0.08
d_yield	0.094 ± 0.09	-0.2	-0.1476	0.017	0.185	0.836
div	1.472 ± 0.246	0.633	1.012	1.193	1.448	3.557
d_div	0.061 ± 0.054	-0.267	-0.01	0.045	0.078	0.478
yi_d1-d0	0.004 ± 0.004	-0.007	-0.005	0.001	0.007	0.036
D_preco	-0.035 ± 0.094	-0.62	-0.273	0.144	0.197	0.35
Pr-sp	0.014 ± 0.065	-0.386	-0.131	0.079	0.144	0.379

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in American Dollars); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 12 - Unagglutinated USA shares (n = 639)

	Mean $\pm$ standard error	minimum	pc 25	median	pc 75	maximum
yield	0.04 $\pm$ 0.0008	0	0.031	0.039	0.047	0.179
d_yield	-0.001 $\pm$ 0.011	-1	-0.102	-0.025	0.067	2.958
div	1.556 $\pm$ 0.039	0	0.889	1.46	2.15	6.579
d_div	0.048 $\pm$ 0.015	-1	0	0.039	0.07	6.821
yi_d1-d0	-0.0005 $\pm$ 0.0006	-0.118	-0.004	-0.0005	0.002	0.151
D_preco	0.068 $\pm$ 0.01	-0.818	-0.058	0.068	0.184	1.595
Pr-sp	-0.0006 $\pm$ 0.01	-1.057	-0.142	-0.015	0.114	1.3

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in American Dollars); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 13 - Unagglutinated German Shares (n = 68)

	Mean $\pm$ standard error	minimum	pc 25	median	pc 75	maximum
yield	0.035 $\pm$ 0.003	0	0.02	0.032	0.05	0.093
d_yield	0.143 $\pm$ 0.117	-1	-0.245	0.003	0.297	7.144
div	1.014 $\pm$ 0.109	0	0.498	0.742	1.436	3.948
d_div	0.21 $\pm$ 0.179	-1	-0.208	0	0.155	11.5
yi_d1-d0	0.002 $\pm$ 0.002	-0.055	-0.01	0.0003	0.015	0.05
D_preco	0.052 $\pm$ 0.032	-0.543	-0.149	0.033	0.264	0.729
Pr-sp	-0.02 $\pm$ 0.03	-0.639	-0.152	-0.02	0.198	0.475

Abbreviations: pc 25: 25th percentile; pc 75: 75th percentile; D\_yield: annual yield variation; Div: dividends paid (in Euros); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 14 - Agglutinated Germany's stocks (n = 1)

Year	D_preço	yield	d_yield	div	d_div	yi_d1-d0	Pr-sp
2008	-0.414	0.036	0.076	1.367	0.224	0.003	-0.01

Abbreviations: D\_yield: annual yield variation; Div: dividends paid (in Euros); D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

Table 15 - Agglutinated versus non-agglutinated Student t test

	Brazil	USA	Germany
yield	NS	NS	NA
d_yield	NS	NS	NA
div	NS	NS	NA
d_div	NS	NS	NA
yi_d1-d0	NS	NS	NA
D_preco	NS	NS	NA
Pr-sp	NS	NS	NA

Abbreviations: D\_yield: annual yield variation; Div: dividends paid; D\_Div: annual variation in dividends paid; Yi\_D1-D0: annual difference between yields; NS: non-significant difference; NA: not evaluated; D\_price: annual variation in share price; PR\_SP: difference between the annual variation of the share and the index of the respective stock exchange for the respective year.

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## FINAL CONSIDERATIONS

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Stock splitting is a subject of great relevance within the study of corporate finance given its peculiarities between sectors and countries. Understanding its relevance and consequences within different contexts makes its importance even greater.

This study aimed to look for differences in the policy of splitting and aggregation of shares in companies in the electricity sector in Brazil, the United States and Germany, given their institutional differences on the subject. The findings are in accordance with the literature, despite having addressed a specific sector subject to its own regulations.

Future perspectives include the study of other countries, especially those where the legislation on dividend taxation is different from that demonstrated by the countries described in this work. Furthermore, other aspects such as concentration of dividend payments and share splits can be very promising topics of study.

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