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THE EX-DIVIDEND-DAY BEHAVIOR OF STOCK PRICES AND VOLUME: THE CASE OF PHARMACEUTICAL DIVIDEND ARISTOCRATS

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This paper presents the wide analysis of the profitability factors of dividend capture strategy on public pharmaceutical companies within a five-year period after the global financial crisis 2008. We investigate the abnormal return and trading volumes with event study, and the effect of price changes around the ex-dividend date under the influence of various factors. Our findings suggest that there are no abnormal trading volumes on both the −1 day of the event window and the day of the event on a subsample of companies that do not declare a dividend before the register close date. We confirm the negative stock yield on the ex-dividend day in most markets. We further confirm the tax hypothesis explaining the behavior of the share price and note the specific behavior of stock prices in the ex-dividend date for companies that do not disclose information on future payments (Japan and South Korea) and on emerging markets. The positive average cumulative abnormal return is statistically significant only for companies with a share of R&D/Total revenue <3%. For companies with a value of more than 3%, the return is negative. An anomaly in the pharmaceutical stock market behavior in the ex-dividend date for 2016 is documented in our paper. A statistically significant price increase is registered both without taking into account the general market behavior, and taking into account market and individual expected return for each share of the sample. The cumulative abnormal returns are greater for pharma companies with a total enterprise value more than $1 billion, except for 2016.

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1. Introduction

Investing in stocks with regular dividend payments and building different strategies have remained its popularity for decades. Dividend shares are a subject of increased interest in periods of high market volatility, in a bear market situation. Different rating agencies allow evaluating the attractiveness of the long term "buy and hold" strategy with the help of special indexes. For instance, S&P High Dividend Aristocrats index, which includes shares of US companies, dividends on which (DPS) have been steadily paid and have not declined for the past 25 years. Today, this index includes 51 issuers (suredividend.com). Another index, Dow Jones Select Dividend, which includes 100 US companies with high dividend yield (ishares.com). Many funds and ETF focus their strategies on indices with a sustainable dividend payment.

Short-term strategies may also be considered by investors, but in this case, they should take into account the country features of the payments (the closing dates of the register, the disclosure rules. tax rates and exemptions), exchange (T + N trading rules) and industry specific factors.

A popular short-term investment strategy is built on the abnormal stock behavior around the register closing date. Specifically, it is talked about the drop in the share price on the ex-dividend date. The key feature of the ex-dividend date is that the stock begins to be traded on the exchange without an announced dividend, and therefore its price becomes lower compared to the previous days. Theoretically, on the perfect capital market, the price should fall exactly on the amount of the dividend that the shareholder receives. In practice, this model assessment is not carried out and the investor can build a trading strategy. Such investment opportunities are analyzed in different national markets (Campbell and Beranek, 1955 for US; Booth and Johnson, 1984 for Canada; Kiyoshi and Loewenstein, 1995 for Japan; Milonas *et al.*, 2006 for China; Teplova, 2010 for Russia; Blandon *et al.*, 2011 for Spain; Nguyen *et al.*, 2014 for French Stock Market).

Since trading on most stock exchanges is conducted in the T + N mode ($t + 3$, in the USA, $t + 2$, in Russia). An investor has to buy shares at the exchange before the register is closed (3 or 2 days earlier) in order to receive a dividend for the previous financial period (year, half year or quarter). Corporate governance standards of most world countries require disclosure of the register closing dates and the amount of expected dividends before the key date.[1] Tax rates for dividends and income which are received from the difference in buying and selling share prices.

[1] These changes have appeared relatively recently for a number of countries. In Japan, firms were not required to declare a dividend before the register was closed in 1995 (Kiyoshi and Loewenstein, 1995), but in the sample of 1507 declared payments, 1354 were made voluntarily before the ex-dividend date. In Russia, there were also no requirements for mandatory disclosure before the closing date of the register until 2013.

Therefore, the investor can rate the profit and risks by comparing the after tax dividend income (as a rule, the actual dividends will be received on the investor's account in 1 to 2 months from the register closing date) in the situation of dividend stocks preservation in the portfolio and after tax income from the dividend stocks sale in the ex-dividend date. The investor's profit from the second strategy will depend on the price drop amount and on the income received tax (tax rates vary by country, by private and institutional investors, also there are exemptions).

Figuring out the expediency of following the strategy, it is important for the investor to anticipate (1) the market price decline coefficients in the ex-dividend date (*PDR, price drop ratio*). PDR in the theory of financial economics should be equal to one, but in practice the value of the coefficient can be either greater or less than one; (2) behavioral aspects of the price movement before the register closing date, when the interest in the dividend capture strategy may generate excessive optimism and deviate share prices from its true value.

The contribution of this paper to the existing literature of investment strategies is the choice of the industry for analysis and consideration of specific industry factors. such as research and development (R&D) as specific risk factors in the implementation of a trading strategy. Since it is important to check the reliability of the conclusions, we evaluate the reaction (*PDR)* in three different ways. We analyze how market investors perceive R&D costs (R&D/total revenue) in forecasting the behavior of the share price. The main research questions addressing these studies are: what specific features of the company are taken into account by the investor when building a short-term dividend strategy? Is the high cost of research a factor that is viewed by investors as highly risky and does not allow building short-term strategies?

Another original factor that is considered in the paper is the liquidity of the stocks. The sample consists of companies from different markets (Appendix A) and the liquidity factor, especially for emerging markets, may be important. To reflect the tax effect on the price reaction, we collected a panel of tax rates on dividends and on income from the sale of shares in 21 countries.

The current paper examines the dividend shares of the pharmaceutical companies of the world and covers fiscal years 2012–2016. The study emphasizes on the stock price behavior and trading volumes around the ex-dividend date. A wide range of investor profitability indicators are considered in the range of 10 days before the ex-dividend date and 10 days after it.

Our interest in pharmaceutical companies is explained by several points. Firstly, pharmaceutical industry is a very large and complex part of the global economy and in individual countries (such as USA and India). Recent estimates of the size of the global pharmaceutical sector in 2017 range from $800 billion to $1130 billion according to different experts (World Preview, 2017, p. 3).

Secondly, it is a fast-growing industry with a high capitalization of companies, whose shares have traditionally been viewed as growth stocks with big P/E RATIO (Appendix D for our sample). Several global demographic and economic trends are driving pharmaceutical consumption and the worldwide market for pharmaceuticals is projected to grow from around $1 trillion in 2015 to $1.3 trillion by 2020 (an annual growth rate near 5%).

The global pharmaceutical industry has grown enormously in just seven years by value. In the middle of 2011, the value of the top 20 companies was $1.45 billion, and in middle of 2017 the 20 companies are worth more than $3 billion. The shares of pharmaceutical industry are traditionally viewed by investors as growth stocks with high values of market multipliers and unstable dividend policy (US Pharmaceuticals & Healthcare Report, 2016). But branch stock indices of pharmaceutical companies do not always outstrip broad stock indexes (Figs. 1 and 2 Appendix C).

Thirdly, the pharmaceutical market is highly concentrated. According to the Capital IQ database, there are 17,373 pharmaceutical companies, 1255 are public and 1061 are listed on at least one stock exchange. The world pharmaceutical sector value pie is led by 17 large global pharmaceutical companies (45% value share) and 277 smaller pharmaceutical companies (23% share). Investors are faced with the choice of current dividends or the potential for an increase in the share price in the future. In 2016, there was a turning point in the dynamics of the industry index for most countries (see Annex 3). This braking effect of the index could change the behavior of investors in traditional dividend payers. We present an analysis of this situation on dividend aristocrats in the pharmaceutical industry.

Fourthly, the special feature of this industry is the high costs of. The pharmaceutical industry is comprised of companies engaged in researching, developing. manufacturing and distributing drugs for human or veterinary use. Many companies combine production and research. There are sub-sectors with very weak financial indicators. which is associated with high costs for R&D. In the United States, more than 90% of biopharmaceutical companies do not earn a profit (2016 ITA Pharmaceuticals Top Markets Report, U.S. Department of Commerce). In common, the pharmaceutical sector has consistently been one of the most R&D intensive industries (Appendix B).

Since the cost of R&D is high (from 6% to 13% of revenue), there is always a risk that the company will stop paying dividends because of a change in strategy and moving to more risky research projects. Nevertheless, there are public companies on the pharma market that pay dividends. Moreover, we select companies that have steadily paid dividends since 2010. There are 3 pharmaceutical companies in the S&P High Dividend Aristocrats Index. 2.68% of included companies in the Dow Jones Select Dividend Index are representatives of the Health Care and Pharmaceuticals Industry. The number of pharmaceutical companies paying dividends to their shareholders has increased by 10% from 2014 to 2016.

Our motivation for research is related to the peculiarities of the functioning of the pharmaceutical industry and the behavior of the prices of shares of companies in this industry. We try to identify the dividend aristocrats in industry, which steadily pay dividends and are attractive by market multipliers (Appendix D) and examine ex-dividend price and volume behavior. We show that it is expedient for investors to use the strategy of dividend capture for all dividend aristocrats of the pharmaceutical industry. This is due to both country specificities (tax rates) and the company's R&D strategy.

The examination of the pharmaceutical companies in this paper allowed to consider more thoroughly at the companies recognized by investors with a high share of intellectual capital and to identify the manufacturers of original and generic drugs. The pharmaceutical

market is one of the steadily growing markets in recent years due to the low-demand elasticity for the products. The graphs of the behavior of the returns of the indices of pharmaceutical companies (Appendix C for the countries with the largest number of companies that were in the sample) show that 2016 was a turning point for this industry. Our research aims to disclose the specific behavior of the share price of dividend aristocrats in this industry in the area of the ex-dividend date. Our hypothesis is that by 2016, investors taking into account the general trend in the price dynamics trend, will be different than in previous years to make trading decisions on the strategy of capturing dividends.

2. Literature Review

In the perfect capital market conditions (Miller and Modigliani, 1961), where there are no transaction costs (taxes and exchange's commissions), everyone has equal access to relevant information, rational investors will be indifferent in the form of obtaining benefits from owning company shares: in the form of dividends or in the form of a price increase. The phenomenon of special stock price behavior on the ex-dividend date was described in 1955 for the first time. Campbell and Beranek (1955) showed that the price decline on the ex-dividend date does not coincide with the declared dividends on the example of shares listed on the New York Stock Exchange (NYSE) within the period 1949–1953. The authors considered two time windows: October 1949 and April 1950 (199 cases of closing register dates) and the last three months of 1953 (200 cases). Changes in prices were measured by two methods: First, as the difference between the closing price on the previous day and the opening price on the ex-dividend day. Second, as a change between the average prices of the two studied days. On average, the price drop on the ex-dividend date was 90% of the declared dividend for both periods. Also, the authors showed that the difference between the opening and closing prices is much greater than the difference between the averages. Campbell and Beranek (1955) concluded that the stock markets practice of automatic bid price reduction on an ex-dividend date in the morning by the amount of the dividend is the cause of such effect until a new stream of applications appears at other prices during the day.

An attempt to deal with such stock price behavior is presented in Elton and Gruber (1970). The authors suggested a hypothesis of a tax explanation for the price behavior: the dividend tax in the USA is higher than the capital gain's tax, so the PDR is not equal to one. The analyses were made for one year (the period from 1st April, 1966 to 31st March, 1967) on the NYSE stocks (4148 observations). Closing prices were chosen as stock prices because the first purchase orders were automatically adjusted by specialists at the market by the amount of the declared dividend. The average value of PDR was obtained equal to 0.777. The result was significant at the 0.015 level of significance. Robustness tests included taking into account the market index behavior of the NYSE (to confirm that the market price of shares was not influenced by any price movements on the market). Blandon *et al.* (2011) performed the examination on the Spanish market on all shares from the IBEX-35 index after 2006, when the tax rates for dividends and capital gains equaled (18%). The authors confirmed the tax hypothesis. There was not statistically significant difference in the price drop from the value of the declared dividend (Blandon *et al.*, 2011).

Stocks with accrued gains have a greater ex-day PDR than stocks with accrued losses (Efthymiou and Leledakis, 2014).

The fixation of increased trading activity in the area of ex-dividend date gave rise to the short-term trading hypothesis. Various classes of investors can trade before and after ex-dividend day and this enables them to avoid or capture dividends. Transaction costs limit dividend capturing so the ex-dividend day premium (when the price falls less than the size of the dividend) varies for stocks with different transaction costs and dividend yields (Kalay, 1982; Karpof and Walking, 1988). The short-term strategy showed an interesting patterns of price behavior in the ex-dividend date. Ex-day raw returns are systematically higher in January than for the other months of the year. For high yield stocks in January, the returns are about one-fourth those for low yield stocks, and for the remaining months they are significantly negative (Bali, 2003). But this conclusion is relevant for the US market, where dividends are paid 4 times a year.

Emerging capital markets have demonstrated a different kind of anomaly: price drop is more than a declared dividend. Milonas *et al.* (2006) found that the PDR for nontaxable shares adjusted for market return was 1.58 versus the predicted value (equal to one) and 1.035 for the sample of taxable shares (not a high statistical significance). Anomalous behavior was found before the change in corporate governance on the Russian market. Only 61.2% of shares fell in price on the ex-dividend dates of 2008, while the other stocks prices increased. The average PDR for the sample was 1.014 (Teplova, 2010), the sample of stocks traded on the MICEX from 2002 to 2009. We consider the tax hypothesis and country differences in corporate governance as the main.

Previous studies suggest that the price increases on the ex-dividend date. For instance, Kiyoshi and Loewenstein (1995) using the sample of 1203 companies from the 1st January, 1981 to the 31st July, 1991 from the Japanese market, find that the PDR is negative [−0.9, −0.8] and statistically significant. It should be mentioned here that a tax income from the sale of shares for private investors was firstly implemented in Japan in 1988. The PDR on the ex-dividend date has changed after this tax policy (−0.807, before the tax introduction and −0.9395, after it). Moreover, the authors revealed that there was a significant negative stock return on shares 5 days before the ex-dividend date, a positive significant stock return on the ex-dividend date, and then fluctuations were observed. The obtained results cannot be fully explained by the tax hypothesis. Since at practically equal tax rates for dividends and capital gains, the PDR should tend to 1. As for most Japanese companies, the ex-dividend date coincided with the beginning of the fiscal year (mainly March) at the moment of research. The authors explained the abnormal result by the "calendar year effect". The analysis of non-dividend shares also led to positive abnormal return at the beginning of fiscal year.

Another possible explanation for the abnormal price behavior is microstructure effects associated with exchange trading. Bali and Hite (1998) explained the anomalous price drop on the ex-dividend date by the feature of tick fixing on the stock exchange. The authors argued that the price drop size will be a multiple of the tick value. Dubofsky (1992)[2] used

[2] The research was done on a sample of 146 341 ex-dividend events (cash payments only), from the 2nd July, 1962 to the 31st December, 1987.

the sample of US market and suggest that the effect of a weak price reaction is related to the "rules" of stock exchanges: NYSE Rule 118 and AMEX Rule 132. Under these rules, a buy order must be "manually" reduced by the amount of the declared dividend when the exchange opens. If the price obtained after the reduction is not a multiple of 1/8 of $ 1 (0.125), then it should be reduced to the nearest multiple of 0.125. Sale orders are not reduced by the amount of the dividend; therefore, an anomalous change in the bid-ask spread is fixed, which generates an abnormal return for the investor. Jakoba and Mab (2004) refuted the teak explanation of the microstructure hypothesis with help of the USA data analysis during the period 1993–2001 (note that the tick was reduced from 1/8 to 1/16).

It is interesting to consider evidence of tax hypothesis when taxes change (Booth and Johnson, 1984). The authors examined the stock behavior on the Canadian stock market for a period spanning four segments with different tax regimes. There was basic equality: $\frac{P_b - P_a}{D} = 1 - t_d$.

Short-term arbitrage strategy supposes to sell shares on the ex-dividend date and receive additional benefit $D \times (1 - t_d)$. The PDR will tend to 1 under the pressure of the market in the absence of transaction costs (everybody starts selling stocks on this date). But it is known that the value of such costs is not significant for institutional investors, while for individual investors it is high. The authors found that the average PDR ranged from 0.403 to 0.491, and PDR was less in 1972 than after it with the predominance of private investors at the Canadian market (the period with the granting of a loan and the decrease in the difference between taxes on dividends and capital gains for such investors). Also, it was mentioned that the PDR with adjusting stock prices for the market index is greater than without it. Nguyen *et al.* (2014) demonstrated the abnormal trading volume (significant at 5% level on the -1 day of the window) and positive abnormal return on the ex-dividend date (significant at 1% level) on the sample of stocks in 2012 on the French market.

Cross-country comparison of price behavior was presented in Isaksson and Islam (2013) for 4677 observations from 2005 to 2009. The authors used data on the blue chip stocks from the world's largest exchanges such as New York (NYSE), Shanghai (SSE), London (LSE) and Tokyo (TSE). The authors argued that it is true that the stock price on the ex-dividend date falls exactly on the amount of the dividend for the NYSE and SSE and investors also do not have an opportunity to get excess profit on these markets (mean value of PDR $= 1$, the value of abnormal return MAAR was not significant). There was no active short-term trading around the ex-dividend date. For TSE, it turned out that the price falls by less than the amount of dividend and (the average value of PDR $= 0.3927$) the possibility of obtaining abnormal return exists. Short-term trading was also confirmed on the interval $[-5; -1]$. In the case of the LSE, on the contrary, the stock price declines more than the dividend amount on the ex-dividend date (mean value of PDR $= 5.9$). Nevertheless, it remains an opportunity to obtain excess profit/income when trading on short positions (the coefficient at MAAR is significant at 1% level).

Connelly *et al.* (2008) revealed a research on 37 different countries. The authors considered different country features for an explanation of the differences in price drop on the ex-dividend date: ownership concentration, disclosure index, pervasiveness of earnings

management across countries (charges for managers' work in financial statements), the efficiency and effectiveness of the judiciary system, trading activity (the total value of traded shares of GDP) and the logarithm of per capita GDP. The authors found that in 19 out of 37 countries, the average value of the difference between the predicted PDR and real ratio is not significant, and in 18 out of 37 countries- remained at 10%, 5% and 1% significance level, and in 14 of 18 countries this difference is only due to the difference in tax rates, and in others due to other factors.

Our results show that the price drop on the ex-dividend date and ex-day premium has a time lag (premium can be obtained on several days) and depends not only on different transaction costs and dividend yields, but also on stocks liquidity and risk characteristics of dividends payers. As a primary proxy risk indicator, we consider R&D costs. Another risk indicator is the small size of the company.

3. Research Hypotheses Development

The price-drop ratio (PDR) is the ratio of the price drop after the cut-off date in absolute terms to the value of the declared dividend for the previous period. Since the price drop may be subject to any sharp changes on the market as a whole. it is necessary to adjust the PDR for market return (exchange index return) or for the expected stock return on a certain model (for example. CAPM) on the ex-dividend date (thus, discounting it to the previous day).

H1: *The average value of the price drop ratio on the pharmaceutical market is equal to one (the mean of PDR* $= 1$*) in each year of the research period.*

According to Elton and Gruber (1970), the PDR differs from its theoretical value due to different taxes on dividends and capital gains. The dividend tax is greater in most countries. Therefore, the price falls less than the dividend amount on ex-dividend date (a certain premium for investors is formed). Each investor decides either to sell shares a day before the ex-dividend date, when the stock price is maximum because it includes the market component and the amount of the declared dividend, and pay the tax on the difference in the purchase and sale prices, or hold these shares, get dividends for the previous financial period and sell them on the ex-dividend date, paying the tax on dividends and on the difference in buy and sell stock prices. Investors' indifference is fixed by the equation: $P_b - t_c \times (P_b - P_c) = P_a - t_c \times (P_a - P_c) + D \times (1 - t_d)$. By transforming this equation, the authors obtained: $\frac{P_b - P_a}{D} = \frac{1-t_d}{1-t_c}$. So, if the rate of capital gains tax is higher, then the PDR should be greater than one. This relation allows us to formulate hypothesis 2.

H2: *The price drop ratio deviation on the ex-dividend date from its theoretical value is due to the difference in tax rates on dividends and capital gains in countries whose pharmaceutical companies are represented in the sample.*

Hypotheses 3 and 4 suggest the existence of abnormal returns and abnormal trading volumes around the ex-dividend date. Since in most countries the dividend tax is more, an increased stock trading volume may be expected the day before the ex-dividend date

(active stock sale in order to avoid an increased tax). However, the outcome depends entirely on what investors prevail on the market, their behavior and benefits. As for the abnormal returns, it is logical to assume that the probability of outperforming the market is not great on the ex-dividend date because of the price drop compared to the previous day. However, the authors of many previous studies have found both positively significant abnormal (Isaksson and Islam, 2013), and negative returns (Novianti *et al.*, 2013).

H3: *On the pharmaceutical market the average value of the abnormal return is zero (mean AR = 0).*

H4: *The average value of the relative trading volume is one on the pharmaceutical market (mean RTV = 1), i.e., the absence of abnormal trading volumes.*

Since the pharmaceutical companies of Japan and South Korea do not announce the amount of the dividend before the ex-dividend date and the closing date of the register, it can be assumed that the stock behavior around the ex-dividend date and the PDR in these countries will differ from the rest of other companies in the sample:

H5: *The stock price behavior and trading volume of pharmaceutical companies in Japan and South Korea around and on the ex-dividend date, as well as the price drop ratio (PDR) will differ from the rest of other companies in the sample.*

H6: *The price drop ratio (PDR), as well as the stock price behavior and trading volumes around and on the ex-dividend date in developed and emerging countries will be different.*

Presence or absence of abnormal returns on the ex-dividend date also depends on the characteristics of the company's performance (investment opportunities, dividend policy, etc.). The hypothesis being tested is that the higher the payout ratio, the greater the price reaction. The stock price behavior will vary for larger and smaller companies. The company's shares liquidity may also have an impact on the presence or absence of abnormal returns. There are significant R&D expenditures in pharmaceutical companies; so, the percentage of R&D expenses of the total revenue can also influence the stock behavior (Chan *et al.*, 1990).

H7: *Such indicators of pharmaceutical companies as the dividend payments. the company's size, the percentage of research and development costs, and the stocks' liquidity of firms affect the average accumulated excess return (CAAR).*

4. Methodology

To test the hypothesis of a tax explanation for the price drop ratio deviation from its theoretical value (one), regression analysis was applied. The actual PDR is a dependent variable in the model (with or without adjustments).

The main variable explanatory is the ratio of tax rates: $\frac{1-t_d}{1-t_c}$, where the dividend tax is presented for the country to which the company belongs. in the denominator — the capital gains tax for the same country.

The detection of abnormal returns and abnormal trading volumes around the ex-dividend date is realized with the help of the event study analysis on the window at 21 days. The indicator of the relative trading volume is calculated similarly to (Isaksson and Islam, 2013):

$$\mathrm{RTV}_i = \frac{V_{it}}{AVTV_i} \tag{1}$$

The formula numerator is the stock trading volume of company i for day t in the event window $[-10; +10]$, and the denominator is the average trading volume of the company in the evaluation period $[-200; -11]$. The normal return for the event window is calculated by the market model.

The PDR is estimated in three ways (2–4). The significance of the obtained results is determinate for both the entire sample and individual subsamples.

$$\mathrm{PDR}_1 = \frac{P_{-1} - P_0}{D}, \tag{2}$$

$$\mathrm{PDR}_2 = \frac{P_{-1} - P_0/(1 + R_m)}{D}, \tag{3}$$

$$\mathrm{PDR}_3 = \frac{P_{-1} - P_0/(1 + E_{r(i)})}{D}. \tag{4}$$

The ex-dividend date price is denoted by P_0, and the previous day price is P_{-1} The market index and stock return are calculated by the next formula: $\frac{P_t - P_{t-1}}{P_{t-1}}$. A market model is used to calculate the expected return on a company's shares.

To determine the factors that could affect the existence of abnormal returns, the sample of companies are divided into two groups in each year by such indicators as: dividend payout ratio (DPOR), total enterprise value (TEV) (Yang and Wu, 2014) and stock liquidity (relative bid ask spread). One of the main items of expenditure for many pharmaceutical companies is research and development costs, and therefore R&D/Total revenue was considered in this paper. It is logical to assume that the percentage of R&D costs is larger in huge companies rather than in small ones; so, the effect of this indicator was analyzed within the groups of companies, divided by quartiles according to its size.

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To sum up, the author divided the whole sample into sub-sample several times: due to DROP-ratio cut points and analyze the results of CAAR, due to TEV and analyze the

Table 1. Final Sample Division According to Cut Points by Groups

Division	Q1-groups		Q2-groups	
1. DROP	>=50%		<50%	
2. TEV	>=$1 billion		<$1 billion	
3. Bid-ask spread	=<0.003 (highly liquid shares)		>0.003 (shares of medium and low liquidity)	
	Q1.1	Q1.2	Q2.1	Q2.2
4. R&D/total revenue	>=10%	<10%	>=3%	<3%

Source: Compiled by the authors.

results (separate from the first case) and so on. Dividing sample due to R&D was within TEV groups. Q1 groups include observations that is less than the cut point, Q2 which is the opposite one.

5. Data and Sample Selection

The purpose of the paper is to investigate the behavior of stock prices around ex-dividend dates considering the stock dividend yield. For this purpose, the data collected from different sources. Thomson Reuters Eikon and Capital IQ databases are the source of stock prices (close bid and ask prices), trading volume, dividend dates, the amount of dividends per share and the required indicators for each company. The stock prices and the amount of the dividend paid were taken in the national currency. Financial companies' indicators (for dividing into quartiles) were fixed in dollars. Final dividend dates for public pharmaceutical companies that consistently paid cash dividends in 2012–2016 are considered in this paper (intermediate ones were excluded from the analysis). From the total companies, only 569 public pharmaceutical companies have ever paid dividends for the period 2012–2016. 115 of them paid stable dividends (all years) for this time period. Following the requirements for data on financial reporting and acceptable shares liquidity, 90 companies have been left in our final sample. Considering the period of 5 years, the analysis will be conducted on 450 observations. Some companies have a listing on two exchanges but the national exchanges were used for the purpose of analysis (for example, comparison of the obtained results in developed and emerging markets). The difference in terms of dividend yield (growth) and dividend yield is recorded (falling against the background of 2012–2016) in 2016. The median R&D/Total Revenue is increasing both for sub-samples of developed (mostly) and emerging countries.

The final sample is quite diverse (21 countries). Japan takes the first place in the number of companies, South Korea second, India third and the USA fourth place. The most common months for the register close dates were March and December. However, it should be noted that almost all companies with such months are representatives of Japan (March) and South Korea (December). A total of 35 out of 90 pharmaceutical companies in the final sample pay dividends twice a year, 11 companies 4 times a year (mainly the USA) and all other companies — once a year. The total sample is divided into two parts (44 and

46 companies, respectively) that announce the amount of dividends before and after key dates. Pharmaceutical companies in Japan and South Korea announce information about the dividends after the register close and the ex-dividend date. The final sample for analyses includes pharmaceutical companies both developed (68 companies, 24 without Japan and South Korea), and emerging (22 companies) markets.

6. Estimated Results

It can be seen from Table 2 that the average value of the PDR on the ex-dividend date differs from its theoretical value (less than one or even less than 0) on the pharmaceutical market in each year of analysis. This difference was significant at 10% and 5% levels in 2012 (without adjustment and with it), at 1% and 5% significance levels in 2013 and 2016. Taking into account the adjustment to the expected stock return, the PDR deviation from one is significant at 5% level in 2015 too. In general, the PDR results with and without adjustments do not differ a lot. Thus, the first hypothesis about the equality of the PDR to one each year of the time period for the entire sample of pharmaceutical companies is rejected. The price increase was revealed on the ex-dividend date in some years of analysis (negative PDR in Table 2) which is consistent with previous studies of Kiyoshi and Loewenstein (1995).

Table 2. The PDR on the Ex-dividend Date for the Entire Sample of Observations by Year (2012–2016)

Year	PDR	*t*-Statistic	PDR (Rm)[a]	*t*-Statistic	PDR (Re)[b]	*t*-Statistic
2012	0.396	−2.144*	0.449	−2.154**	0.277	−2.786**
2013	−0.035	−3.419***	0.393	−2.249**	−1.919	−1.100
2014	0.304	−1.620	0.470	−1.252	0.094	−2.083**
2015	0.155	−1.428	0.437	−1.141	−0.051	−2.281**
2016	−0.278	−2.805***	−0.341	−3.134***	−0.456	−3.364***

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.
[a]The price drop ratio adjusted for market index return.
[b]The price drop ratio adjusted for expected stock's return.

The results of testing the tax hypothesis on explaining the price change on the ex-dividend date are shown in Tables 3 (three models). Two Japan companies showed abnormal PDR and were excluded from the analysis, the number of observations was reduced to 440.

All obtained regressions are statistically significant. What is more, the coefficient with the predicted value of PDR is also everywhere significant at 1% level (with a positive effect on the real value of PDR). The R-squared is not very high, which is explained by the presence of other factors affecting the real PDR besides taxes. The results are consistent with prior studies (Connelly *et al.*, 2008). Thus, the second hypothesis (H2) stated in this paper was confirmed.

Table 3. Regression Results. The PDR Without any Adjustments

Models	Model 1 (the PDR Without any Adjustments)	Model 2 (the PDR Adjusted for the Market Index Return)	Model 3 (the PDR Adjusted for the Expected Stock Return)
Dependent variable	pdr	pdr_m	pdr_e
Independent variable		exp_pdr	
Cons	−4.995	−5.164	−4.635
(P-value > |t|)	(0.001)***	(0.005)***	(0.002)***
Coef.	5.535	5.593	5.260
(P-value > |t|)	(0.000)***	(0.000)***	(0.000)***
Prob > F	0.0003***	0.0001***	0.0001***
R^2_{adj}	0.31	0.38	0.34
Number of observations	440	440	440

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

The results of testing the third (H3) and fourth hypotheses (H4) showed (Tables 6 and 7) that there is a negative average abnormal return on the ex-dividend date, the significance of which is determined at 1% level. The third (H3) and fourth (H4) hypotheses are rejected. A negative significant excess return exists on the 3rd day after the event, but there is a positive average abnormal return on the 6th day of event, statistically significant at a 0.05 level (also significant at 1% level). The investors will be more profitable if they sell shares on the 6th day after the ex-dividend date in order not to face the problem of falling prices. Abnormal trading volume is observed on −3, −1, 0, 6, 7 and 8 days of event, which indicates an increase in activity of sales/purchases on the market on the ex-dividend date. A positively significant cumulative abnormal return and abnormal trading volume on −1 day of event suggest that investors who do not use the dividend capture strategy actively sell the shares until dividend fixing.

Table 4 shows significant abnormal returns on the ex-dividend day ($t \neq 0$). Therefore, the null hypothesis indicating that the mean abnormal return on the ex-dividend day was zero is rejected at 1% significant level. A negative significant excess return exists on the 3rd day after the event, but there is a positive average abnormal return on the 6th day of event, statistically significant at a 1% level. This implies the investors will be more profitable if they sell shares on the 6th day after the ex-dividend date in order not to face the problem of falling prices. Abnormal trading volume is observed on −3, −1, 0, 6, 7 and 8 days of event (Table 5), which indicates an increase in activity of sales/purchases on the market on the ex-dividend date. A positively significant cumulative abnormal return and abnormal trading volume on −1 day of event suggest that investors who do not use the dividend capture strategy actively sell the shares until dividend fixing.

This result is somewhat surprising because it contradicts most of the empirical evidence worldwide showing that stock prices fall less than the dividend paid. In this paper, ex-dividend days are not different from ordinary days in terms of abnormal returns. In

Table 4. Abnormal Returns in the Window [−10; +10] for the Entire Sample of Companies for the Entire Period of Time (2012–2016)

Event window	AAR	*t*-Statistic	CAAR	*t*-Statistic
−10	−0.001	−0.619	−0.001	−0.577
−9	0.001	0.260	−0.001	−0.385
−8	−0.001	−0.156	−0.001	−0.512
−7	0.000	0.050	−0.001	−0.471
−6	0.001	0.688	0.000	0.041
−5	0.002	1.745*	0.001	1.004
−4	0.001	0.475	0.002	1.413
−3	0.001	0.176	0.002	1.564
−2	0.001	0.332	0.002	1.816*
−1	0.001	1.236	0.003	2.824***
0	−0.005	−5.121***	−0.003	−2.285**
1	0.001	0.822	−0.002	−1.599
2	−0.001	0.956	−0.003	−2.510**
3	−0.004	−3.785***	−0.006	−5.708***
4	0.001	1.414	−0.005	−4.391***
5	0.001	1.034	−0.004	−3.565***
6	0.003	3.807***	−0.001	−0.637
7	0.001	1.108	0.001	0.462
8	−0.001	−0.365	0.000	0.088
9	−0.001	1.456	−0.001	−0.325
10	0.002	−0.767	0.002	−2.257**

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

addition, although non-significant, the ex-dividend day abnormal return is negative, while previous research indicates it should be positive. Interestingly, a positive and significant abnormal return is also evident on the day prior to the ex-dividend date ($t = -1$). As before, the same result is observed independently of the model used to estimate abnormal returns. Low-dividend yield stocks do not show any significant abnormal return after ex-dividend days.

It is recommended to sell shares either on the 6th day or on the 10th day of the event window and buy shares 11 days before the ex-dividend date (if cumulative abnormal return is considered).

Hypotheses 5 and 6 are confirmed. The stock prices behavior and trading volumes behavior for a subsample of companies (44) that do not disclose information on dividend payments before the register close date (Table 6) differs from the results of a sample of companies with full disclosure (Table 7).

The average value of price drop ratio is even less than zero in 3 out of 5 cases, which talk about not a decline in prices on the ex-dividend date but about prices' growth on this day. There are no abnormal trading volumes on both the −1 day of the event window and the day of the event (ex-dividend date) on a subsample of companies that do not declare a

Table 5. Abnormal Trading Volumes on the Exchange

Event Window	ARTV	*t*-Statistic
−10	1.144	1.569
−9	1.047	0.703
−8	1.053	1.121
−7	1.078	1.475
−6	1.065	1.208
−5	1.056	1.127
−4	1.125	1.868
−3	1.161	2.666**
−2	1.031	0.864
−1	1.148	3.197***
0	1.125	2.016**
1	1.053	0.720
2	1.067	0.955
3	1.056	1.345
4	1.054	1.243
5	1.035	0.737
6	1.086	1.667*
7	1.226	3.243***
8	1.164	2.564**
9	1.088	1.321
10	1.196	1.053

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Table 6. The PDR on the Ex-dividend Date for the Sample of Companies that do not Declare Dividend Information Before the Register Close date by Years (2012–2016)

Year	PDR	*t*-Statistic	PDR (Rm)	*t*-Statistic	PDR (Re)	*t*-Statistic
2012	0.012	−4.114***	0.109	−4.480***	−0.003	−4.762***
2013	−0.436	−7.055***	−0.109	−5.958***	−1.658	−2.112**
2014	−0.074	−3.577***	−0.024	−3.675***	−0.382	−4.477***
2015	−0.434	−3.741***	−0.467	−4.487***	−0.536	−4.595***
2016	0.003	−2.800**	0.100	−2.663**	0.074	−2.715**

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

dividend before the register close date (abnormal results appear only on the 7th day, Tables 10 and 11). Cumulative abnormal return becomes positive only by the 10th day of the event window (with statistical significance). We can assume that investors do not rely on analysts' forecasts on these markets and do not pay any attention to the key dividend.

Table 7. The PDR on the Ex-dividend Date for the Sample of Companies that Declare Dividend Information Before the Register Close Date by Years (2012–2016)

Year	PDR	*t*-Statistic	PDR (Rm)	*t*-Statistic	PDR (Re)	*t*-Statistic
2012	0.797	−1.426	0.806	−1.237	0.570	−2.890**
2013	0.395	−2.752**	0.932	−0.358	0.657	−1.744*
2014	0.096	−8.647***	0.381	−5.358***	0.026	−7.621***
2015	0.714	−1.065	0.647	−1.396	0.229	−3.178***
2016	0.586	−5.615***	−0.827	−7.065***	−1.038	−7.836***

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Table 8. Dynamics of Average Abnormal Returns on a Sample of Japanese and South Korea Companies for the Period 2012–2016

Event Window	AAR	*t*-Statistic	CAAR	*t*-Statistic
−10	−0.001	−0.661	−0.001	−0.759
−9	−0.001	−0.616	−0.002	−1.282
−8	−0.001	−1.092	−0.003	−2.204**
−7	−0.000	−0.094	−0.003	−2.285**
−6	−0.001	−1.071	−0.004	−3.172***
−5	0.001	1.212	−0.003	−2.260**
−4	0.002	1.450	−0.001	−0.755
−3	0.001	0.705	−0.000	−0.095
−2	−0.001	−0.677	−0.001	−0.687
−1	0.001	0.998	0.000	0.072
0	−0.004	−3.364***	−0.004	−3.189***
1	0.001	1.295	−0.003	−2.124**
2	−0.001	1.192	−0.004	−3.069***
3	−0.004	−3.153***	−0.009	−6.380***
4	0.001	0.805	−0.008	−5.550***
5	0.002	1.629	−0.006	−4.178***
6	0.004	3.253***	−0.002	−1.417
7	0.004	2.676**	0.002	1.427
8	−0.001	−0.269	0.002	1.082
9	0.001	0.941	0.002	1.608
10	0.007	−0.769	0.009	−3.413***

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Higher trading volumes are fixed on the seventh day of the event window (Table 9). Cumulative abnormal returns and abnormal returns are negative on the ex-dividend date (Table 8).

It can be seen from the Table 10 that the results differ from those obtained earlier.

Table 9. Average Abnormal Trading Volumes Analysis on a Sample of Japanese and South Korea companies for the Period (2012–2016)

Event Window	ARTV	*t*-Statistic
−10	1.275	1.546
−9	1.140	1.073
−8	1.064	0.928
−7	1.094	1.110
−6	1.038	0.626
−5	0.987	−0.253
−4	1.145	1.259
−3	1.170	1.910*
−2	0.996	−0.066
−1	1.039	0.709
0	1.004	0.089
1	0.949	−0.963
2	1.061	1.106
3	1.061	1.009
4	1.047	0.879
5	1.006	0.105
6	0.992	−0.132
7	1.238	2.570**
8	1.144	1.438
9	1.048	1.588
10	1.074	1.035

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Hypothesis 6 about special price behavior on emerging capital markets has been confirmed. An increase in prices on the ex-dividend date is observed for these countries, the significance of the obtained results is confirmed at 1% level (Table 10). The significance of negative abnormal return was not confirmed on the ex-dividend date, but a significant

Table 10. The PDR on the Ex-dividend Date for the Sample of Companies from Emerging Countries by Years (2012–2016)

Year	PDR	*t*-Statistic	PDR (Rm)	*t*-Statistic	PDR (Re)	*t*-Statistic
2012	−1.061	−9.905***	−0.731	−9.774***	−0.761	−9.221***
2013	−1.084	−12.829***	−0.817	−12.109***	−0.922	−12.692***
–	0.178	−6.540***	0.224	−6.909***	−0.257	−8.003***
2015	−0.871	−11.256***	−0.490	−8.801***	−0.661	−9.802***
2016	−0.551	−5.490***	−0.270	−5.410***	−0.419	−5.929***

Source: Author's calculations using the Stata program.
Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Table 11. Analysis of the Average Cumulative Abnormal Return Depending on the Shares Liquidity

Year	> 0.003	< 0.003
2012	0.002	0.014
2013	0.009	−0.009
2014	−0.022	0.003
2015	−0.014	0.002
2016	−0.022	0.006
Average	−0.009	0.003
t-Statistic	−1.432	2.952**

Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

positive abnormal return is observed on the −6 and 4 days of the event window. There are abnormal trading volumes on −4, −2, −1, 0, 6, 7, 8 and 9 days of the event window.

In general, it can be concluded that the average positive significant abnormal return exists on the 6th day after the ex-dividend date for both the entire sample and the sub-samples (except emerging markets). But there is a negatively significant abnormal return on the ex-dividend date. Therefore, if an investor wants not only to take advantage of the dividend capture strategy on pharmaceutical market (the reason for which is a smaller price fall on the ex-dividend date), but also to earn excess profit then it is better to sell shares on the 6th day after the event.

The average cumulative abnormal return is positive for all sub-samples (at 1%. 5% or 10% significance levels) on the 10th day of the event window. If an investor purchases the shares before the event window, then it is profitable for him to sell them after capturing the dividend on the 10th day. Therefore, the average cumulative abnormal return (CAAR) will be used for further analyses. Table 11 shows the sub-samples of stocks with high and low liquidity (the bid ask spread values).

A positive significant average cumulative abnormal return (at 5% level) was found for companies with high liquidity (< 0.003), and negative (but not significant) return was found for less liquid stocks (Table 11). This result can be explained as follows: liquid shares are more in demand on the market, so after the ex-dividend date, when the stock price begins to recover after the fall/drop/decline — investors are more interested in such shares, their price grows faster. For example, if investors still do not use the dividend capture strategy and sell shares before the ex-dividend date in order not to pay the tax, then they will be more likely to choose those shares that are liquid on the market. In addition, such shares are more advantageous for short-term operations — the ability to sell and buy them quickly on the market.

Tables 12–14 show the quartiles of companies with different characteristics of size and investment behavior. Cumulative abnormal returns are greater for pharmaceutical companies with a TEV > $1 billion than for smaller ones in all years, except for 2016. Nevertheless, the significance of the company's size impact on cumulative excess returns was not confirmed (Table 12).

Table 12. The Importance of the Company's Size (TEV) for Fixing the Cumulative Abnormal Return on the 10th Day After the Ex-dividend date

Year	>$1 billion	<$1 billion
2012	0.008	0.008
2013	0.002	0.004
2014	0.002	−0.015
2015	0.002	−0.012
2016	−0.011	−0.009
Average	0.001	−0.005
t-Statistic	1.658	1.489

Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Table 13. Analysis of the Average Cumulative Abnormal Return Depending on the DPOR

Year	>50%	<50%
2012	−0.020	0.021
2013	0.025	−0.008
2014	0.001	−0.009
2015	−0.023	0.002
2016	−0.012	0.009
Average	−0.006	0.003
t-Statistic	1.207	1.998*

Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

Table 14. Analysis of the Average Cumulative Abnormal Return Depending on the R&D/Total Revenue Ratio

	TEV > $1 billion		TEV < $1 billion	
Year	Q1.1 R&D/Total Revenue > 10%	Q1.2 R&D/Total Revenue < 10%	Q2.1 R&D/Total Revenue > 3%	Q2.2 R&D/Total Revenue < 3%
2012	0.001	0.017	−0.001	0.015
2013	0.008	−0.011	−0.004	0.011
2014	−0.023	0.019	−0.042	0.008
2015	−0.013	0.015	−0.013	0.011
2016	−0.012	−0.008	0.007	−0.027
Average	0.002	0.006	−0.011	0.004
t-Statistic	5.017***	4.476***	−1.606	2.493***

Significance levels: *$p < 10\%$, **$p < 5\%$, ***$p < 1\%$.

A positive significant (but only at 10% level) average cumulative abnormal return exists for pharmaceutical companies that declare a dividend less than other companies in the industry on the market. It can be concluded that investors on the pharmaceutical market react negatively neat ex-day to a larger amount of dividend payments (with higher dividend yields), and the share prices of such companies begins decreasing after ex-day. For large companies (TEV $>$ \$1 billion), there is a positive significant average cumulative excess return with any ratio of R&D costs. Very high costs alarm investors, so for companies with a share of less than 10% observed profitability is higher (these shares attract investors more). The issue of cost control for small companies is even more important. The positive average cumulative abnormal return is statistically significant only for companies with a share of R&D/Total revenue $< 3\%$. For companies with a value of more than 3%, the return is negative, but insignificant.

7. Conclusion

Our paper deals with the short-term trading hypothesis that emphasizes that investors can trade before and after ex-dividend day and this enables them to avoid or capture dividends. We demonstrate that the specific characteristics of the capital market (institutional features) and industry risk (R&D costs) influence the benefits of the short-term trading strategy. Investor should take into account patterns in price movement for several days around ex-dividend day. The PDR of pharmaceutical companies turned out to be smaller than its theoretical value (one), which is consistent with previous studies on cross-industry and cross-country samples (Elton and Gruber, 1970; Isaksson and Islam, 2013).

There is a price increase, not a decline for Japan and South Korea, as well as for emerging markets. Such result can be explained for Japan and South Korea by the hypothesis of "the fiscal year end", when investors are reviewing their portfolio of shares. The tax hypothesis (the ratio of tax dividends rates and capital gains influence over PDR in different countries) was confirmed at 1% significance level for pharmaceutical companies, which is consistent with the study of Connelly *et al.* (2008). We note that in South Korea, for Chaebol firms was documented (Choi and Min, 2015) some features of financial behavior (high-leveraged capital structure and non-traditional cash holding).

Our results suggest that information about dividends and dividend dates is important for investors. Increased trading volumes were observed both on the -1 day before the event and on the day of the event itself (for the entire sample), which is consistent with many previous studies (Yang and Wu, 2014). Information disclosure is important: for companies that did not announce the amount of the dividend before the register close date, there were no abnormal trading volumes on the ex-dividend date and the day before.

In developed capital markets, the dividend capture strategy exists for pharmaceutical industry after 2008–2009 global crisis. Abnormal trading volumes were observed on the day after the event for companies except Japan and South Korea, what was not found in

other sub-samples. This behavior can be explained by the fact that investors either actively use the dividend capture strategy on this market and sell the shares immediately after fix date as dividend recipients, or vice versa, having got rid of shares before the register close date in order not to pay the tax on dividends, they again actively buy shares on the-ex dividend date and after it.

Hypothesis about special price behavior on emerging capital markets has been confirmed. An increase in prices on the ex-dividend date is observed for these markets. This confirms the conclusion for the companies of different sectors of the Russian market (Teplova, 2010). There are abnormal trading volumes before and after ex-day.

In general, it can be concluded that the average positive significant abnormal return exists on the 6th day after the ex-dividend date for both the entire sample and the sub-samples (except emerging markets). But there is a negatively significant abnormal return on the ex-dividend date.

The hypothesis about the influence of certain characteristics of pharmaceutical companies on the stock behavior around the ex-dividend date — on the cumulative abnormal return on the 10th day of the event window, where it had turned out to be positively significant, was not confirmed everywhere. The result is significant at 5% level for companies with more liquid stocks on the market, a similar result was obtained in Yang and Wu (2014). The result was also significant for companies with a dividend payout ratio of less than 50%, but only at the 10% level, which may indicate that investors react negatively to the announcement of a higher dividend by companies.

Investors have a potential opportunity to obtain excess return after capturing a dividend selling pharmaceutical shares on the 6th or 10th day of the event window. Japanese and South Korea companies require scrutiny analysis when building a strategy because of the lack of information about the dividends and vulnerability of stock prices due to seasonal effect on ex-dividend date.

Appendix A. Number of Markets and Companies

Market (Source of Separation: Database Capital IQ)	Number of Companies in the Sample	Market and Company Examples	Number of Companies by Market
Developed	68	Singapore: Haw Par Corporation Ltd	1
		US: Merck & Co Inc	6
		Italy: Recordati S.p.A	1
		Belgium: UCB SA	1
		Japan: Ono Pharmaceutical Co Ltd	25
		Denmark Novo Nordisk A/S	2
		Germany: Stada Arzneimittel AG	3
		Switzerland: Novartis AG	2
		UK: Glaxo Smith Kline PLC	3

(*Continued*)

Market (Source of Separation: Database Capital IQ)	Number of Companies in the Sample	Market and Company Examples	Number of Companies by Market
Emerging	22	France: Ipsen SA	3
		Spain: Laboratorios Farmaceuticos ROVI SA	1
		S. Korea: Daewoong Pharmaceutical	20
		Hungary: Richter Gedeon Vegyeszeti Gyar Nyrt	1
		India: Dr. Reddy's Laboratories Ltd	12
		Israel: Teva Pharmaceutical Industries Ltd	1
		Vietnam: Imexpharm Corp	3
		Taiwan: China Chemical & Pharmaceutical Co Ltd	2
		Slovenia: Krka dd Novo Mesto	1
		Pakistan: Highnoon Laboratories Ltd	1
		South Africa: Aspen Pharmacare Holdings Ltd	1

Appendix B. Mean Values for Sub-samples

	R&D/Revenue					Payout Ratio (%)	
	2012	2013	2014	2015	2016	2013	2016
Developed	7.582	7.554	7.357	7.321	7.833	31.9	35.66
Emerging	0.67	0.57	0.99	0.82	0.88	26.8	28.0

Appendix C. Pharmaceutical Index Dynamics with Braking in 2016

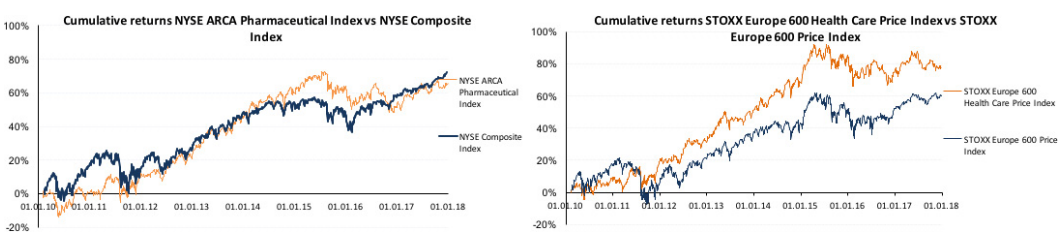

Figure C.1. Comparable Statistics of Indexes in USA and Europe 2010–2017 (There are 6 USA Pharmaceutical Companies and 15 European Pharmaceutical Companies in the Research Sample, respectively)

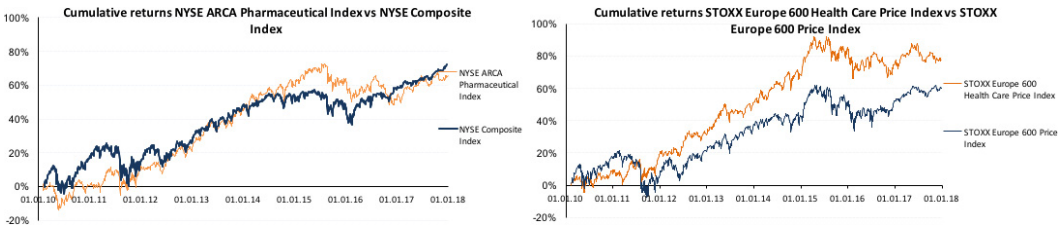

Figure C.2. Comparable Statistics of Indexes in Japan and India 2010–2017 (There are 25 Japanese Pharmaceutical Companies and 12 Indian Pharmaceutical Companies in the Research Sample, Respectively)

Appendix D. Market Ratio: Comparison by Our Sample of Dividends Aristocrats and Country Index

		P/E RATIO							
	Firm name	2010	2011	2012	2013	2014	2015	2016	2017
India Ticker									
ADRG.NS	Aarti Drugs Ltd	6.21	4.00	7.55	5.45	14.34	19.39	18.89	21.06
ARBN.NS	Aurobindo Pharma Ltd	15.41	27.27	31.89	25.23	19.42	29.87	17.07	16.71
CIPL.NS	Cipla Ltd	27.36	25.96	29.07	22.04	44.30	29.44	53.17	42.80
REDY.NS	Dr.Reddy's Laboratories Ltd	80.36	26.87	23.96	28.32	28.25	22.76	44.33	33.41
JULS.NS	Jubilant Life Sciences Ltd	13.34	11.38	237.69		12.64	22.19	22.41	22.58
LUPN.NS	Lupin Ltd	27.28	21.62	28.60	26.35	28.12	38.89	23.92	21.96
NECT.NS	Nectar Lifesciences Ltd	7.38	3.56	6.43	4.86	12.68	18.33	13.64	15.78
SHME.NS	Shilpa Medicare Ltd	12.39	10.18	15.63	17.83	34.97	47.47	45.97	43.22
SUN.NS	Sun Pharmaceutical Industries Ltd	25.64	27.86	28.51	60.04	27.11	73.61	20.97	43.27
SUVP.NS	Suven Life Sciences Ltd	40.64	12.93	24.56	26.60	19.07	34.80	30.63	29.69
TORP.NS	Torrent Pharmaceuticals Ltd	16.73	14.18	21.09	16.46	22.35	16.87	20.75	29.03
	Average	**24.79**	**16.89**	**41.36**	**23.32**	**23.93**	**32.15**	**28.34**	**29.05**
	Nifty 50 Index								**21.77**
Japan Ticker									
4514.T	ASKA Pharmaceutical Co Ltd	0.00	54.19	19.69	23.93	44.61	55.36	30.13	16.88
4503.T	Astellas Pharma Inc	17.34	19.28	21.27	35.05	32.59	22.46	16.85	16.10
4519.T	Chugai Pharmaceutical Co Ltd	17.37	17.05	23.14	23.69	30.83	39.35	32.45	46.64
4568.T	Daiichi Sankyo Co Ltd	16.62	19.54			15.83	35.35	26.96	50.58

(*Continued*)

		P/E RATIO							
	Firm name	2010	2011	2012	2013	2014	2015	2016	2017
4577.T	Daito Pharmaceutical Co Ltd	9.19	9.39	8.17	7.75	10.19	16.35	11.02	15.02
4523.T	Eisai Co Ltd	16.97	14.94	20.66	21.47	72.86	52.55	26.76	60.72
4554.T	Fuji Pharma Co Ltd	14.32	6.93		12.77	15.08	15.96	19.07	19.70
4538.T	Fuso Pharmaceutical Industries Ltd	14.32	29.49	16.11	6.71	24.30	102.98	81.07	35.89
4530.T	Hisamitsu Pharmaceutical Co Inc	14.25	17.93	17.77	19.61	18.82	23.51	28.03	28.06
4521.T	Kaken Pharmaceutical Co Ltd	12.74	10.87	13.49	15.16	18.27	18.15	12.73	11.06
4547.T	Kissei Pharmaceutical Co Ltd	25.38	16.91	19.85	19.08	16.62	22.76	17.58	19.05
4508.T	Mitsubishi Tanabe Pharma Corp	19.52	19.52	16.39	16.14	20.11	27.54	21.48	20.19
4534.T	Mochida Pharma-ceutical Co Ltd	12.46	15.00	11.57	15.25	15.30	18.50	18.10	19.28
4541.T	Nichi-Iko Pharmaceutical Co Ltd	22.01	17.47	16.57	16.03	17.54	24.19	10.36	19.40
4516.T	Nippon Shinyaku Co Ltd	22.30	14.20	17.30	29.42	52.00	50.61	41.72	39.71
4528.T	Ono Pharmaceutical Co Ltd	19.43	19.71	17.26	41.77	94.05	106.61	37.39	25.69
4536.T	Santen Pharmaceutical Co Ltd	14.75	12.44	17.61	24.51	26.21	14.39	26.75	28.10
4555.T	Sawai Pharmaceutical Co Ltd	16.91	18.16	16.42	19.41	20.08	19.68	13.45	11.52
4507.T	Shionogi & Co Ltd	15.84	15.50	14.26	10.47	35.81	32.74	24.20	19.21
4506.T	Sumitomo Dainippon Pharma Co Ltd	17.29	19.67	41.08	83.91	20.12	33.64	35.64	12.56
4581.T	Taisho Pharmaceutical Holdings Co Ltd	19.99			19.44	20.86	29.98	31.58	26.36
4502.T	Takeda Pharmaceutical Co Ltd	12.50	11.15	28.11	35.45	44.13		25.36	30.80
4551.T	Torii Pharmaceutical Co Ltd	14.90	274.50	18.51	41.09	27.55	22.37	24.79	22.05
4553.T	Towa Pharmaceutical Co Ltd	14.52	9.21	13.98	13.62	11.33	11.71	22.73	11.14
4540.T	Tsumura & Co	16.12	13.15	12.13	12.64	11.03	16.41	20.01	18.70
	Average	**15.71**	**28.18**	**18.32**	**23.52**	**28.65**	**33.88**	**26.25**	**24.98**
	Nikkei 225								**15.71**

(*Continued*)

		P/E RATIO							
	Firm name	2010	2011	2012	2013	2014	2015	2016	2017
US Ticker									
BMY.N	Bristol-Myers Squibb Co	13.73	18.17	29.78	31.94	36.26	65.01	29.17	24.11
LLY.N	Eli Lilly and Co	8.03	9.92	13.38	11.64	27.62	38.10	31.94	40.22
JNJ.N	Johnson & Johnson	12.71	15.99	23.01	20.44	17.31	19.69	20.21	24.28
MRK.N	Merck & Co Inc	12.87	27.73	18.61	33.29	30.89	14.07	29.95	54.55
PRGO.N	Perrigo Company PLC	23.83	27.00	22.88	32.44	146.34	150.87	262.64	
PFE.N	Pfizer Inc	23.27	16.43	21.16	20.43	19.19	24.17	32.03	22.25
	Average	**15.74**	**19.20**	**21.47**	**25.03**	**46.27**	**51.99**	**67.66**	**33.08**
	NYSE Composite Index								**20.24**
Germany Ticker									
BAYGn.DE	Bayer AG	28.60	21.19	24.42	27.20	26.18	26.48	20.15	24.57
MRCG.DE	Merck KGaA	20.24	32.20	50.74	23.73	29.39	30.69	29.11	21.03
STAGn.DE	Stada Arzneimittel AG	22.57	14.98	15.10	20.20	11.83	41.47	25.37	57.93
	Average	**23.80**	**22.79**	**30.09**	**23.71**	**22.47**	**32.88**	**24.87**	**34.51**
	DAX								**15.17**
Korea Ticker									
003850.KS	Boryung Pharm Co Ltd	11.94	20.79	25.64	20.07	15.80	20.34	27.67	
069620.KS	Daewoong Pharma	9.97	6.21	9.62	12.76	22.25	0.00	35.98	43.18
000640.KS	Dong-A Socio Holdings Co Ltd	5.25	3.07	4.67		540.32	17.13	5.97	16.63
000020.KS	Dongwha Pharm Co Ltd	28.08	5.12	12.33		81.60	55.50	22.38	10.20
004310.KS	Hyundai Pharmaceutical Co Ltd	8.24			35.89	70.69	58.37	72.56	64.12
003120.KS	Ilsung Pharmaceutical Co Ltd	17.36	10.17	2.33	5.41	66.38	30.34	1.71	48.55
002620.KS	Jeil Pharmaceutical Co Ltd	1.73	1.04	2.72	13.34	39.61	27.22	28.90	
001060.KS	Jw Pharmaceutical	15.03	40.88				100.05		70.86
009290.KS	Kwangdong Pharmaceutical Co Ltd	5.90	5.72	8.84	13.45	12.99	12.24	10.83	15.79
102460.KS	Reyon Pharmaceutical Co Ltd	6.36	5.80	10.22	18.65	21.72	35.86	41.14	24.49
000520.KS	Samil Pharmaceutical Co Ltd	0.00	11.49			27.30		140.28	

(*Continued*)

		P/E RATIO							
	Firm name	2010	2011	2012	2013	2014	2015	2016	2017
016580.KS	Whanin Pharm Co Ltd	5.67	5.95		10.86	19.23	14.28	12.82	15.04
000100.KS	Yuhan Corp	16.77	11.35		23.10	18.33	23.67	16.00	18.26
000220.KS	Yuyu Pharma Inc	19.13	15.95		10.41	55.08			10.64
	Average	**10.18**	**10.63**	**9.55**	**16.39**	**76.25**	**32.92**	**34.69**	**30.71**
Ticker									
072020.KQ	Choong Ang Vaccine Laboratory	22.11	0.00	26.70	22.15	21.86	64.80	29.93	21.88
067080.KQ	DaeHwa Pharm Co Ltd	6.28	48.42	34.31	40.19	142.58	596.30	113.03	87.23
041910.KQ	EstechPharma Co Ltd	11.16	11.99	16.19	11.97		91.96		29.29
011040.KQ	Kyungdong Pharm	7.06	5.65	7.58	25.99	12.11	15.03	11.79	11.80
000250.KQ	Sam Chun Dang Pharm Co Ltd		15.41	19.96	17.21	18.35	31.99		
	Average	**11.65**	**16.51**	**21.19**	**23.14**	**49.13**	**157.06**	**43.28**	**36.44**
France Ticker									
BOIR.PA	Boiron SA	11.93	11.33	10.78	15.75	17.81	15.59	19.65	18.12
IPN.PA	Ipsen SA	14.47	18.36	23.28	32.92	22.80	36.03	24.35	38.34
SASY.PA	Sanofi SA	10.32	15.98	15.93	33.98	24.99	20.54	23.85	19.92
	Average	**12.24**	**15.22**	**16.66**	**27.55**	**21.87**	**24.05**	**22.62**	**25.46**
	CAC40								**15.4**
UK Ticker									
ALAPH.L	Alliance Pharma PLC	11.14	7.60	11.06	10.54	11.32	13.78	9.71	14.53
AZN.L	AstraZeneca PLC	8.29	6.34	32.35	16.15	87.31	50.61	28.10	24.74
GSK.L	GlaxoSmithKline PLC	15.84	22.68	13.45	20.37	15.81	6.66	260.51	27.84
	Average	**11.76**	**12.21**	**18.95**	**15.69**	**38.15**	**23.68**	**99.44**	**22.37**
	FTSE 100								**19.18**

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