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Master Thesis U.S.E.

“The effect of marijuana legalization on cannabis stocks returns”

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Abstract

The thesis investigates the effect of the announcement of cannabis legalization for medical as well as recreational purposes on cannabis stocks returns. I do the research for legalizations for USA states and other countries over years from 2008 until 2021. Moreover, by introducing dummy variables into the model, I check if the fact of legalization being announced during a hot legalization year and if it was legalized for recreational use influence the magnitude of the effect. In order to check it, I perform an event study by calculating CAAR for every legalization date for the event window from three days before until three days after the legalization. The results are that the legalization of cannabis decreases CAARs in the selected period on average by 0,7% at a 95 % confidence level and that dummy variables proposed by me do not explain this effect or their influence is negligibly minor. The study is important from the scientific perspective as it enriches the literature about cannabis stocks which is narrow but also from the real perspective as it provides a conclusion that investors should not invest in cannabis stocks in the closest days to the legalization as it does not lead to earning abnormal returns.

Keywords: Cannabis legalization, Cannabis stocks, Cumulative Average Abnormal Return

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1. Introduction

The thesis investigates the effect of cannabis legalization in US states and worldwide on cannabis stocks performance and tries to find variables that influence this effect. In 2022, it is fifty-six years after California legalized the usage of cannabis for medical purposes becoming the first state to do it. It is noticeable how the perception of this drug has changed since that time. The possibility of treatment with cannabis-based medicines is no longer unusual for anyone. Moreover, acceptance of recreational marijuana use is growing (Wen et al., 2019). Consequently, there are more and more companies specializing in the growth, distribution, and sale of marijuana for both medical and recreational purposes. A big part of them especially from the United States and Canada became big enough to go public. Their appearance draws the attention of investors searching for new opportunities to allocate their money. Along with the substantial change in public perception of cannabis, the legalization of marijuana became a quite frequent event recently. There are many indications that this trend will not change soon. Conversely, the German government announced in early 2022 that the legalization of marijuana for recreational use is on the agenda.

The problem addressed by the study is important from an investor's perspective. Probably we will witness further legalizations in the next years. The thesis aims to examine if those events cause the prices of stocks involved in the cannabis business to provide additional returns and if so, under which conditions. It is especially relevant because there has been a noticeable increase in interest in cannabis stocks in recent years, especially among retail investors (Andrikopoulos et al., 2021). Moreover, the answer to this question is valid also from the scientific perspective. As of now, the literature about cannabis stocks is very limited but it is possible to notice its growth during recent years. Nevertheless, the impact of legalizations was never measured before. Therefore, it is the first study that answers the question of whether cannabis legalization affects the returns of cannabis companies' stocks.

The thesis is divided as follows. In the next section, I formulate the relevant theories and predict output based on the scientific literature. At first, I refer to papers about specifically cannabis stocks and their behavior as a result of events similar to marijuana legalization. Then, I include the cannabis stocks in the group of sin stocks, which is important because for this group more research regarding for example the impact of investor sentiment, was carried out. Moreover, I explain how legalization can solve a significant problem for the

sin companies in general, but for cannabis companies in particular, which is access to capital. Finally, I provide the broader context of theories that may affect the result of the study. In the next section, I describe the methods of data collection and development of models which aim to check the impact of introduced dummy variables on the Cumulative Average Abnormal Returns. The following section is the description of the results. I discover that legalization has a significant and slightly negative effect on cannabis stock returns. Later, I use econometric models to investigate if the any of developed variables have an impact on the size of abnormal returns. The result of the models is that none of the variables proposed by me is statistically significant or its' effect is extremely small. The thesis's final part is the discussion and conclusions, where I confer the limitations of the model and its implication of it for the investment industry.

2. Literature review and theoretical framework

The selection of this topic is particularly motivated by the fact that the literature about cannabis stocks is relatively scarce but has recently seen more attention. The literature review part is organized following a bottom-up approach. I start with describing research made particularly on the effects of legalization and entering the cannabis business on cannabis companies and their stocks, later I include a section about the factors which influence the performance of the group to which cannabis stocks belong which is the sin stocks, then I elaborate on industry and sin stock specific issue which is the problem with the access to the capital and finally, I outline the impact of not cannabis industry-specific factors for which there are reasons to believe are consequences of legalizations.

2.1 Theories about the impact of legalization and company entering the cannabis business on cannabis stocks' returns

Chen et al. (2021) find that the announcements of recreational legalization entering the new level of jurisdictional process in Canada did not affect the returns of cannabis-related stocks. However, the research was done on a small sample of ten Canadian stocks and the authors only took into consideration one legalization (of recreational cannabis in Canada in 2018) and events leading up to it (for example the liberal party being elected to the parliament, or the bill being introduced to the parliament). My input compared to their study is checking if the type of legalization influences the cannabis stocks returns. To do it I develop the following hypothesis: *medical legalization has a significantly different effect on cannabis stocks returns than the recreational one (first hypothesis)*. According to my knowledge, it was not done before and Chen et al. (2021) only measured the impact of recreational legalization. Because of the different nature of those two types of legalization, I expect medical legalization to have a different effect on cannabis stock returns than a recreational one. Weisskopf (2020) points out that those types of marijuana use differ when it comes to the target audience and potential source of profits. The medical business is mostly focused on research and drug distribution similar to the pharmaceutical one. Whereas the second part of the business is more comparable to the alcohol or tobacco industry. Therefore, the impact of legalizations on shares should be different for both of those segments depending on which one of them is perceived by the market as the more profitable one.

Afik et al. (2021) discover that the cannabis industry became attractive for investors in the period from 2017 until 2019 which was intensive regarding the number of cannabis legalizations (21 countries decided to legalize the use of medical marijuana).¹ According to their research, the announcement of the company entering the cannabis-related business activity caused the Cumulative Average Abnormal Return to jump by 64 % during the time window of one day before until one day after the announcement. Such a change is extremely seldom seen. What also this study describes is that CAAR starts to significantly rise in the relatively long time of 15 until 6 trading days before the event which means that the announcement is already anticipated by the market. The reason for that may be the insider knowledge or previous announcements suggesting that the company will decide to enter the cannabis business. Based on this conclusion, it can be stated that if entering the cannabis business was seen as good news for investors also the legalization of medical or recreational marijuana should be seen this way and consequently increase the returns of the industry. This theory is in opposition to the results of studies made by Chen et al. (2021). Therefore, my thesis resolves the dispute by testing the following hypothesis which is the main hypothesis of the study: *legalization of marijuana for medical or recreational purposes significantly affects cannabis stocks returns (second hypothesis)*. Arguments in support or against this hypothesis are given in the following segments of the literature review.

2.2 Cannabis stocks as a part of the sin stocks category

Because the recreational segment of the cannabis business meets similar needs as alcohol and tobacco, cannabis stocks may be classified as sin stocks. Blitz & Fabozzi (2017) underlined that marijuana stocks should be qualified for this group, but they did not consider them in their research because there was not enough data about them when they were writing the paper. Liston (2016) discovers that the portfolio of sin stocks is heavily dependent on investors' sentiment regarding the market. Therefore, the investors' sentiment should also have an effect on a particular group of sin stocks which are cannabis stocks. Intensification of legalization processes around the world shall have a positive, amplifying effect on the investors' sentiment on the marijuana companies' market. It is worth adding that cannabis stocks are characterized by low beta to the market so also the negative investors' premonitions regarding the overall stocks market should not have a noticeable effect on their

¹ See Table 1 in the Appendix.

sentiment toward the cannabis market (Weisskopf, 2020).² Another implication of being included in the group of sin stocks is the reluctance of some investors to invest in harmful companies. It is particularly important in case of mutual funds implementing strategies to avert investing in sin stocks as part of the ESG strategy. Hong & Kacperczyk (2009) find that especially institutional investors avoid investing in sin stocks. By excluding cannabis companies from their portfolios, they can improve ESG scores which high score is perceived as the key indicator for those funds (Alessandrini & Jondeau, 2020). Intuition can imply that a lack of institutional investors investing in cannabis stocks should lower the effect of cannabis legalization. Moreover, it would be a proper time for ESG-oriented funds for excluding cannabis companies from their portfolios. Cannabis legalizations are usually loud events. Therefore, it may be the best occasion for those funds to show their commitment to investors and values by avoiding investing in cannabis stocks during the time when those stocks are perceived as hot and profitable investments. Also, then investors who are against the usage of cannabis for recreational purposes would be more interested in investing in funds which invest in line with their beliefs.

2.3 Industry's limited access to the capital

One characteristic of sin companies that is even more pronounced especially for cannabis companies is the difficulty in accessing capital. It was proven that CSR companies have the access to cheaper capital than the companies involved in sin industries (El Ghouli et al., 2011). However, it does not stop sin stocks from significantly outperforming the market which is explained by the risk premium for penalty payments that can be imposed on those stocks in the future (Schröder, 2014). Nevertheless, we can conclude that limited access to capital is the limiting factor for the development of cannabis-related companies. Legalizing marijuana could significantly help to solve this problem. After the legalization, the cannabis company will have the incentive to enter another market (it is precisely described in the next section). It was proven that companies that enter the market abroad by for example moving their headquarters there increase their access to the multinational capital (Baaij et al., 2015). Especially small and big companies operating in the cannabis industry have problems with access to banking services even in such developed economies like the USA (Merz & Riepe,

² Compared to other sin industries cannabis coefficients to the market are the lowest ones. For example using Fama-French 5-factor model Weisskopf calculates that beta towards market of the cannabis companies equals to 0.484 when corresponding coefficient calculated for beer, tobacco and weapons industries equals to respectively 0.718, 0.861 and 0.556. The defensive, below 1 beta of sin industries is confirmed also by Hong & Kacperczyk, (2009) in their research.

2021) when the access to banking services is still crucial for those firms to develop (Berg, 2018). Hilt (2015) points to the federal legalization of marijuana in the US as the possible solution for simplifying the access of American cannabis companies to the banking system. The reason for that is that so far under federal law it is illegal to provide banking services to companies involved in the cannabis-related industry.³ Therefore, legalization opens the door to funding by for example banks that operate only in those states where marijuana is legal. It is worth noticing the development of a new banking niche – banks that agree to provide services to cannabis companies. However, in exchange, those institutions offer their services at a higher interest rate (Wade, 2022). Therefore, using their services is not the optimal solution for obtaining capital for cannabis companies.

2.4 Not industry-specific factors

The broader context of the not cannabis industry-related factors and theorems which may influence the effect of whether legalization affects cannabis companies' returns is compared to the understudied cannabis stocks, well studied. Binder (1985) based on the sample of many unrelated laws discovers that in most cases the day of the new regulation announcement should not have an impact on stock returns because this information is usually anticipated by the market, so it was already absorbed in prices of stocks. Therefore, according to this theorem if the legalization as the special case of the regulatory change was already expected it should not have an effect on stocks returns on days close to legalization. This result is not in line with the findings of Afik et al., (2021) of positive CAAR during the event window of the announcement.⁴ Therefore, my study fills the gap in the literature by investigating which study is more appealing to the actual announcements of legalizations.

The next line of reasoning is that the event of legalization is associated with taking the meaningful part of the new market by already existing players. In case of the cannabis industry, those are usually companies based in the United States or Canada. From their perspective, the legalization of medical or recreational cannabis can be seen as an opportunity for geographical expansion. Doukas & Travlos (1988) describe the positive effect of the

³ When Hilt was writing the paper (2015) there was not any important project of the bill which may simplify the access of capital provided by federal banks. However, in April 2021 the H.R.1996 - SAFE Banking Act of 2021 passed the House. In April 2022, the bill still has not been considered in the Senate. The purpose of the bill is to prohibits a federal banking regulator from penalizing a depository institution for providing banking services to a legitimate cannabis-related business. See: <https://www.congress.gov/bill/117th-congress/house-bill/1996>.

⁴ See section 2.1

company entering the foreign market on its stock performance. They conclude that this effect is particularly significant if the firm had no prior presence in the expansion country. More substantial effects are observed for countries whose economies are less developed than the American one. Although the research concerns acquisitions, it can be assumed that a similar effect can be expected just for starting a business in a different country. Those results are contrary to what Chung et al., (1993) discovered about the effect of the announcement of the creation of international joint ventures. According to it, the announcement has a negative effect on the stocks' performance of the companies which decided to take part in the joint venture process. This empirical conclusion is not in line with the research made by Contractor (2007) according to which international expansion is beneficial for the company after meeting certain assumptions. Moreover, it is not in line with the observable trend of companies to become international.

There are shreds of evidence in the literature that being hot or cold markets have an impact on the stocks' performance of the companies which are part of this industry. Following Yung et al. (2008) heat of the market is defined as the intensity of the events during a particular time (in the case of their research it was the number of IPOs). Derrien (2005) described that Initial Public Offers made during markets frequently lead to shares being overpriced, positive initial returns, and poor long-run performance of the stocks. The effects of market heat were also observed in the case of firms' mergers and acquisitions. Chidambaran et al., (2010) discovers that mergers and acquisitions happening in hot periods are associated with stocks of acquires being overvalued compared to the cold period. Although the research was done for IPOs, mergers, and acquisitions, it is reasonable to suspect that overall investors' bullish perception of the market during a time of intensive legalizations can cause shares to react similarly. To sum up, the logic behind this theorem is that many legalizations during a particular year cause investors to be more fervent about the market, its stability, and its future which will amplify their willingness to pay more for the stocks of the companies which will benefit in the next legalization in the already intensive legalizations period. Therefore, my research will also test the following hypothesis: *the legalization which was during the years when the number of legalizations exceeds the average was associated with statistically different cannabis stocks returns than those which happened during below the average or average years (third hypothesis)*. Based on the literature described above I expect that the hot legalization period should have a more positive effect on cannabis stock returns than the cold one.

2.5 Summary

The lack of scientific literature on the effects of marijuana legalization on cannabis stocks performance and the presence of many factors that can influence the results of the study undoubtedly make the outcome of the research unpredictable in advance. However, based on the available literature from the different disciplines, it is possible to find which factors can influence it. It is known that the cannabis industry is perceived as attractive by investors and therefore investors' sentiment can have a positive impact on stocks returns after legalization. However, it was discovered that in case of the new law implementation the prices of stocks that are affected by the change of the law already absorb the change in the prices even if only because those changes are usually predictable in advance. On the other hand, given that the legalization of marijuana creates an opportunity for the company to enter a new market, the expected effect should be positive. The fact that more and more mutual funds invest in accordance with ESG standards may decrease the effect of legalization because of the lack of those funds' interest in investing in cannabis stocks. At this point also the role of legalizations in solving companies' problems with access to capital should be emphasized. To sum up, theories of investors' sentiment, market expansion, and providing access to the capital should increase returns on cannabis companies, on the other hand, the efficient markets hypothesis (legalization already absorbed in stock prices) and the fact that many institutional investors avoid investing in the marijuana stocks due to the ESG policies should decrease potential returns on cannabis stocks resulting from marijuana legalization.

3. Methodology and Empirical Strategy

In this section, I briefly describe the process of data collection and creation of the model.

3.1 Data collection

Dates of legalizations are not easily accessible. Therefore, I use many sources to obtain them like local journals, and government or parliamentary portals.⁵ In terms of legalization dates, I distinguish four types of events:

- a) Legalization of medical marihuana in one of the US states or inhabited territories
- b) Legalization of medical marihuana in other country than USA
- c) Legalization of recreational marihuana in one of the US states or inhabited territories
- d) Legalization of recreational marihuana in other countries than USA

What I use as the legalization event is the announcement of the certain legalization of cannabis in a particular country or state. In most countries, this is the date of the second parliamentary vote on the bill. In some systems, the president has the veto law after the bill is accepted. However, this law is relatively rarely used in practice, and in case of marijuana legalization, it has never been used. That is the reason I choose to take into consideration the day of the last parliament voting rather than the date of the president signing the bill. There are countries where not the parliament is responsible for cannabis policy. In that case, I take the announcement of the relevant authority (government, Ministry of Health, or Supreme Court). Another cannabis-related legal term is decriminalization, which in general is the decision not to punish the possession of small amounts of marijuana. However, as decriminalization does not allow for the production or legal sale of cannabis it is not relevant to classify it as the event for the purpose of my study. Moreover, it was found that it does not affect consumption (Thies & Register, 1993). I use 68 events for medical marihuana (30 for the US states and inhabited territories and 38 for the rest of the world) and 26 events for the recreational one (21 and 5 respectively). Therefore, I have 84 legalizations in total. The time frame of the event study is from 04.11.2008 (medical cannabis legalization announcement in Michigan state) until 13.10.2021 (medical cannabis legalization in Panama). The selection of this particular time frame is motivated by the fact that not many cannabis-focused companies were listed before 2008. Sometimes, more than one legalization happened in one day. It was

⁵ Data on legalization dates with the corresponding sources can be found in Tables 1-4 in the Appendix.

particularly observable for US states.⁶ However, it does not cause obstacles in terms of gathering data because in that case observations were of the same type (recreational or medical) but it limited the number of events to 74. I use a time window of three trading days before until three trading days after the event so in total, I have a time window of seven trading days. Choice of this length of event window is popular for CAAR analysis event studies (Wright et al., 2002; Kroll et al., 1997).

The cannabis industry was dynamic in terms of mergers, acquisitions, and the formation of new companies during the time frame of the study. Therefore, the number of companies used to calculate CAAR changed depending on the event as some of them were taken over or collapsed during the time frame of the event study. The list of events with a number of companies that were used to calculate the corresponding CAARs for every event is presented in Table 5 in the Appendix. I get the data on cannabis stocks returns from FactSet.⁷

To obtain the firms' characteristics which I use as the control variables in panel data analysis, which is described in Section 3.3, I followed the approach of Lins et al. (2017). Those firm-specific characteristics are: market capitalization, long-term debt, short-term debt, cash holdings, profitability, book-to-market ratio, idiosyncratic risk, and a dummy variable for those companies which book to market is negative. I decided to omit the momentum factor as I control for it using the Carhart model, which is described in detail in the next paragraph. The summary statistics and correlation matrix are presented in the final part of this chapter. I get data for firm characteristics from Wharton Research Data Services. As cannabis companies are relatively small, there is no data available for all their characteristics in WRDS. Therefore, I decide to exclude companies for which data is missing from the panel data model but include them for CAAR calculation and time-series model.

⁶ For example on 8th of November 2016, seven states legalized the recreational use of cannabis. See Table 6 in the Appendix.

⁷ See Table 8 or Table 9 in the Appendix for the list of companies which I use in the study.

3.2 CAARs calculation

The expected return which I use for the event study is calculated based on Carhart Four Factor Model (Carhart, 1997) which is the Fama and French model (Fama & French, 1993) extended with the momentum factor. The Four Factor model is represented by the following equation:

$$E(r_{i,t}) - r_{f,t} = \alpha_{i,t} + \beta_{1i}(r_{m,t} - r_{f,t}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}WML_t + \epsilon_{i,t}, \quad (1)$$

where $E(r_{i,t})$ is expected return of the stock i on the day t , $r_{f,t}$ is the risk-free rate, $r_{m,t}$ is the return of the market and SMB , HML , and WML are respectively the size, the book to market, and the momentum factors of the Carhart model.

All four factors are taken from Kenneth French website.⁸ Following the approach of Gerritsen and van Rheenen (2017), coefficients are estimated for the time window of 270 until 10 trading days prior to the event.

The purpose of using the regression above is to calculate the expected returns of the stocks. The event study is constructed in a similar way as Capron and Pistre (2002) do in their research. Therefore, the next step is to calculate the expected excess return based on the formula below:

$$E(R_{i,t}) = E(r_{i,t}) - r_{f,t} \quad (2)$$

After that, I calculate the actual excess return based on the actual stock's returns using Equation 3:

$$R_{i,t} = r_{i,t} - r_{f,t} \quad (3)$$

Then, I compute the abnormal return by subtraction of expected excess returns from the actual excess returns:

$$AR_{i,t} = R_{i,t} - E(r_{i,t}) \quad (4)$$

Following, I compute average abnormal returns (\overline{AR}_t) which are the averages of all stocks' abnormal returns during a particular day during the time window:

$$\overline{AR}_t = \frac{1}{N} \sum_{i=1}^N AR_{i,t}, \quad (5)$$

where N is the number of stocks that I use to calculate expected excess returns on day t .

⁸ See: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Average abnormal returns are cumulated across the time in the event time window in order to calculate cumulative average abnormal returns for every event k (ECAAR):

$$ECAAR_k (T_1, T_2) = \sum_{t=T_1}^{T_2} \overline{AR}_t \quad (6)$$

T_1 and T_2 in the equation above are referring to the particular days of the event window which in case of my study ranges from 3 days before until 3 days after the event.

Therefore, cumulative average abnormal return is calculated for every event. What I do next is to check whether the sum of CAARs of the event study is statistically different from 0 by carrying t significance test as it was suggested by Boehmer (1991):

$$t_{CAAR} = \frac{\overline{CAAR}}{\sigma_{CAAR}} * \sqrt{E} \quad (7)$$

where E is the number of events, \overline{CAAR} is the average of CAARs and σ_{CAAR} is their standard deviation.

I also calculate CAARs in a second way, by firstly cumulating them for particular dates of the event time window (T_1, T_2) to obtain Cumulative Abnormal Returns (CAR) for every event k for every company and later average them for companies, to obtain CAARs for every company (CCAAR) on which I perform event study. In order to do it I use the following formulas:

$$CAR_{i,k} = \sum_{t=-3}^3 AR_{i,t} \quad (8)$$

$$CCAAR_i = \frac{1}{N} \sum_{i=1}^N CAR_{i,t} \quad (9)$$

3.3 Models

In this section, I describe three models which aim to check which factors influence CAARs. The first one is time series regression which examines variables that can affect Cumulative Average Abnormal Returns calculated for every event (Event Cumulative Average Abnormal Returns).

Regression is presented below:

$$ECAAR_t = \alpha_t + \beta_1 recreational + \beta_2 USA + \beta_3 legalization\ year + \epsilon_t, \quad (10)$$

where *recreational* is a dummy variable for the type of legalization (1 if recreational use of cannabis is legalized, 0 if only medical)⁹, *USA* is dummy variable for the territory of legalization (1 if legalization applies to one of USA states or inhabited territories, 0 otherwise) and *legalization year* is a dummy variable for the year of legalization (1 if legalization occurred in the year in which an above-average number of legalizations took place, 0 if legalization occurred in the year in which an average or below-average number of legalizations took place).

I decide to introduce the variable *USA* because I expect that legalization which was in one of the USA states should have a different impact than the legalization which happened in a different country. The reason is that all the companies in the sample are Canadian or American. Therefore, especially for American ones, it is easier to enter a new market if only from a geographical or legal point of view, if that market has opened in one of the U.S. states.

Every variable except for *legalization year* is previously known. Its importance was explained in the section of the literature review about the impact of the heat of the industry. The purpose of introducing this dummy is to check whether the industry being hot or cold in the particular year of legalization impacts CAARs. A hot year is classified as the year during which above the average number of legalizations happened. All the years that are not hot are cold ones. To categorize events if they belong to an above-average legalization year following formula is used:

$$\bar{L} = \frac{L}{T}, \quad (11)$$

where T is the number of years and L is the total number of legalizations which equals 74.

⁹ Sometimes country legalizes both types of cannabis use at the same time. In that case the dummy variable takes the value of 1.

After calculating the average number of legalizations per year, I classify every year as if it belongs to the intensive in terms of legalizations year (above the average) or not.

The second model is the cross-sectional regression which investigates the impact of the time-invariant variable which is the nationality of the company on the CAARs calculated separately for every company (Company Cumulative Average Abnormal Returns). As in the sample there are no companies based in different countries than the United States or Canada, the dummy variable takes the value of 1 if the firm is from US and 0 if from Canada. The regression formula looks as follows:

$$CCAAR_i = \alpha_i + \beta_1 \text{nationality of the company} + \epsilon_i \quad (12)$$

The final model of the thesis is the panel data that takes the Cumulative Abnormal Returns calculated for every company and every event as the explained variables. Based on it, it is possible to conclude which company characteristics and which dummy variables used for previous models influence the Cumulative Abnormal Returns of the legalization. The regression equation for the described model looks as follows:

$$\begin{aligned} CAR_{i,t} = & \beta_0 + \beta_1 \text{recreational} + \beta_2 \text{USA} + \beta_3 \text{legalization year} + \text{Time dummies} \\ & + \text{Firm fixed effects} + \beta_{12} \text{USA} * \text{nationality of the company} + \epsilon_{i,t} \end{aligned} \quad (13)$$

Variables *recreational*, *USA*, *legalization year* are the same dummy variables that I use for the time series model. Following Lins et al. (2017) approach I include *Time dummies* and *Firm fixed effects* to control for respectively time and firm fixed effects. Time dummies are specified at the yearly level and firms' specifics are respectively: *market capitalization*, *long term debt*, *short term debt*, *cash holdings*, *profitability*, *book to market*, *negative book to market*, and *idiosyncratic risk*. I estimate the model using a fixed-effect model clustered by companies. The consequence of choosing the fixed effect model is that the variables which are time-invariant need to be excluded. Therefore, the nationality of the company is not analyzed as a single variable but as the interaction term between *nationality of the company* and *USA* variables. The logic behind introducing the interaction term between those two variables is that the impact of legalization in the United States should have a different impact on American companies than on Canadian ones. Even because of the distance, it is easier for US firms to enter another state with their product than Canadian ones, especially if the second ones do not operate in the USA yet. In order to avoid the issues

caused by outliers, I winsorize the CARs at the 1st and 99th percentile as Lins et al. (2017) do in their study.

3.4 Descriptive statistics of the company specifics

The summary statistics of cannabis companies are presented in the table below:

	<i>Mean</i>	<i>Standard deviation</i>	<i>25th percentile</i>	<i>Median</i>	<i>75th percentile</i>
<i>CAR</i>	0,0001	0,0014	-0,0008	-0,0002	0,0005
<i>Market Capitalization (millions of dollars)</i>	1200,3341	2682,4498	77,8952	238,6555	755,3391
<i>Long-Term Debt</i>	0,2840	1,7557	0,0000	0,0718	0,2043
<i>Short-Term Debt</i>	0,1655	0,51116	0,0013	0,0151	0,0533
<i>Cash Holdings</i>	0,3096	0,2813	0,0782	0,1990	0,4743
<i>Profitability</i>	-20,9589	176,2376	-2,4371	-0,7441	-0,1129
<i>Book-to-Market</i>	0,36599	0,7904	0,0823	0,2508	0,5716
<i>Negative Book-to-Market</i>	0,1343	0,3410	0,0000	0,0000	0,0000
<i>Idiosyncratic Risk</i>	1,0506	19,3424	0,0066	0,0149	0,0296

Table 3.1: Summary statistics of companies' specific variables

What can be spotted based on the results of the summary statistics is the high volatility of two variables: *Profitability* and *Idiosyncratic Risk*. Moreover, the profitability of those companies is characterized by a big negative mean of -20,935. It is interpreted that the operating loss is on average 20,935 bigger than the value of assets. It may be caused by the inclusion in the sample companies which are close to bankruptcy.

I also get the correlation matrix for the company specifics. The result is shown in the following table:

	<i>CAR</i>	<i>Ln (Mkt Cap)</i>	<i>L/T Debt</i>	<i>S/T Debt</i>	<i>Cash Hold.</i>	<i>Profit.</i>	<i>B/M</i>	<i>Neg. B/M</i>
<i>Ln (Mkt Cap)</i>	0,0284	1,000						
<i>L/T Debt</i>	0,0337	-0,1128	1,000					
<i>S/T Debt</i>	-0,1006	-0,2206	0,0617	1,000				
<i>Cash Hold.</i>	-0,0026	0,0044	0,0076	-0,0387	1,000			
<i>Profit.</i>	-0,0137	0,0543	0,0103	0,0110	-0,1936	1,000		
<i>B/M</i>	0,0062	-0,0314	-0,0876	-0,3527	-0,0617	-0,0034	1,000	
<i>Neg. B/M</i>	-0,1086	-0,3338	0,2386	0,5657	-0,0346	0,0046	-0,4378	1,000
<i>Idiosyn. Risk</i>	0,0476	-0,0283	-0,0014	0,0217	-0,0453	0,0047	-0,0234	0,0712

Table 3.2: Correlation matrix of companies' specific variables

As it can be seen the variables are not in general correlated. Therefore, when it comes to the firm specifics, I do not assume multicollinearity in models. The strongest and at the same time negative correlation can be observed between variables *B/M* and *Negative B/M* which is -43,7%. It is reasonable because the value of the Book to Market ratio should be correlated with a dummy variable whose value depends on whether the Book to Market ratio is positive or negative.

4. Results and interpretation

4.1 CAARs calculation and analysis

Cumulative average abnormal returns (CAARs) are calculated for every event in line with the previous section in which I describe methods. CAARs calculated for all the events are presented in Table 6 in the Appendix. Moreover, I obtain the significance statistics and mean for CAARs calculated for every event. The results are presented in the table below:

	[-3,3]	-3	-2	-1	0	1	2	3
Mean	-0,0075	-0,0019	-0,0038	-0,0010	-0,0003	0,0009	-0,0014	0,0001
Standard deviation	0,0319	0,0101	0,0271	0,0055	0,0031	0,0124	0,0052	0,0065
t-value	-2,0170	-1,6492	-1,2167	-1,5886	-0,8575	0,6208	-2,2589	0,1001
p-value	0,0474	0,1034	0,2276	0,1165	0,3939	0,5367	0,0269	0,9205

Table 4.1: Event CAARs characteristics

The table shows statistics for the Cumulative Average Abnormal Returns in the whole-time frame of the event (-3,3) as well as separately for particular days of the event window. The mean of all event CAARs is equal to -0,75% with a corresponding standard deviation of 0,0319. Therefore, the p-value is 0,047 which means that CAARs are jointly statistically different from 0 at a 95% confidence level. Consequently, it can be stated that the legalization causes cumulative average abnormal returns of companies to decrease by 0,7 % in the time period of 3 days prior until 3 days after the legalization. The result is quite surprising as it is not in line with the expected result predicted in the literature section because even if I found the theories that state about the lowered or even negative effect, the majority of theoretical arguments are in support of the positive impact of legalization on cannabis companies returns. The mean of Cumulative Average Abnormal Returns is significant only two days after the event and is close to being significant one and three days before the event. The mean of day two of the event study time window is equal to -0,14% and the corresponding p-value is 0,027 which is interpreted that with a 95% confidence level

legalization decreases the Cumulative Average Abnormal Returns on average by -0,14%, two days after the event occurs. As some of the CAARs are close to the significance, I decide to group daily CAARs into the time intervals of -3 to -1, -3 to 0, 0 to 3, and 1 to 3 to check if any of these intervals are statistically significant. The results are shown in the table below:

	[-3,3]	[-3, -1]	[-3,0]	[0,3]	[1,3]
Mean	-0,0070	-0,0068	-0,0071	-0,0007	0,0004
Standard deviation	0,0320	0,0421	0,0426	0,0150	0,0149
t-value	-2,0170	-1,3874	-1,4316	-0,3952	-0,2226
p-value	0,0470	0,1695	0,1565	0,6938	0,8244

Table 4.2: Event CAARs for particular time intervals

Based on the p-values obtained from Table 4.2 it can be seen that for every time interval except the already analyzed whole event window, CAARs are not statistically different from zero. Time intervals of -3 to -1 and -3 to 0 are the closest ones to the significance. It is worth adding that for all the time intervals, except for from one day after the event until three days after the event, the average of CAARs is negative.

4.2 Company Cumulative Average Abnormal Returns (CCAAR)

The results of calculating the CAAR for every company are presented in Table 8 in the Appendix. As for the CAARs calculated for every event, I also compute summary statistics for those CAARs. Results are shown in the table below:

	All the companies	Canadian	American
Average	-0,0119	-0,0047	-0,0205
Standard deviation	0,0705	0,0205	0,1016
Number of companies	150	82	68
t-value	-2,0804	-2,1022	-1,6735
p-value	0,0392	0,0386	0,0988

Table 4.3: Companies CAARs characteristics

The average of companies' CAARs is slightly negative as it equals -1,19% and it is significant at the 95% confidence level. In the above-presented table, I split CAARs calculated for particular companies based on the nationality of the company. For both Canadian and American firms, I get statistically significant CAARs at respectively the 95% and 90% confidence levels. Having established that legalization has an effect on average CAAR, I want to examine exactly for which firms this effect is statistically significant. Therefore, I get the p values for every company which is investigated in the event study. The results are presented in Table 7 in the Appendix. The main conclusion from it is that the Company CAARs are significant at least at the 90% confidence level for 75 out of 150 firms. Moreover, the vast majority because as many as 55 observations are significant at the 95% confidence level.

4.3 Time series model

After discovering that legalization significantly causes CAARs calculated for events to decrease in the event window of 3 days prior until the 3 days after the legalization, I want to investigate which factors have an impact on CAARs. The first model which was introduced in the methods section is the time series model of CAARs calculated for every event regressed on three dummy variables: *recreational*, *USA* and *legalization year*. The results of the regression are shown in the table below:

Variables	ECAAR
<i>recreational</i>	-0,0013 (0,0095)
<i>USA</i>	0,0078 (0,0081)
<i>legalization year</i>	-0,0017 (0,0092)
<i>constant</i>	-0,0094 (0,0089)
Observations	74
R-squared	0,015
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

Table 4.4: Time series regression output

As it can be seen, none of the 3 dummy variables is a good predictor of CAARs. P values of the variables *recreational*, *USA* and *legalization year* are respectively 0,895, 0,338, and 0,855 which means that none of them is statistically significant even at a 90 % confidence level. Moreover, the R^2 of the model is as low as 1,5%.

4.4 Cross-sectional model

The second model is cross-sectional regression and its purpose is to investigate if the nationality of the company has an impact on Cumulative Average Abnormal Returns calculated for every Company (CCAAR). To remind, the *nationality of the company* is the dummy variable which takes the value of one when the company is American and zero when it is Canadian. As it is the time-invariant variable, then it is reasonable to investigate its' impact in the cross-sectional model. The results of the regression are presented in the table below:

Variables	CCAAR
<i>nationality of the company</i>	-0,0160 (0,0116)
<i>constant</i>	-0,0048 (0,0078)
Observations	150
R-squared	0,013
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 4.5: Cross- sectional regression output

Variable *nationality* is not significant at any rational confidence level, so the nationality of the company does not have an impact on the Companies Cumulative Average Abnormal Returns (CCAARs). The corresponding p-value equals 0,168 which is not close to the significance even at a 90% confidence level. Therefore the country of the company does not have any significant impact on the volume of Cumulative Average Abnormal Returns caused by the announcement of cannabis legalization.

4.5 Panel Data model

The last model of the thesis is the panel data regression. Following the approach of Lins (2016) I use a fixed-effects model with standard errors clustered at the firm level. I omit those firms for which control variables are not available in the WRDS database. Therefore, I use a sample of 40 companies. I run the regression of Cumulative Average Returns (CARs) calculated for every event and every company on dummy variables used for the time series model and the interaction term between the *nationality of the company* and *USA* variables. The particular dummy variable of *nationality of the company* is omitted because it is the time-invariant variable that cannot be used for the fixed-effect model. I also run the same regression but with control for firm characteristics and time-fixed effects. Contrary to previous models, two dummy variables are statistically significant in case of both regressions. For the regression including firm characteristics and time fixed effects significant are *recreational* and *legalization year*, both at a 99% confidence level. However, corresponding coefficients are respectively -0,0004 and 0,0005 which indicates an extremely small effect. Moreover, it is worth noticing the increase of R^2 caused by adding control variables and time-fixed effects from 0,8% to 7,1 %.

VARIABLES	CAR	CAR
<i>recreational</i>	-0,0002*** (5.90e-05)	-0,0004*** (6.50e-05)
<i>legalization year</i>	8.55e-05 (0,0002)	0,0005*** (0,0001)
<i>USA</i>	-0,0002** (8,20e-05)	3,00e-05 (7,63e-05)
<i>1.USA#1.nationality of the company</i>	7,08e-05 (0,0002)	0,0001 (0,0002)
<i>constant</i>	-8,40e-05 (0,0001)	-0,0003 (0,0002)
Firm characteristics	No	Yes
Time (yearly) fixed effects	No	Yes
Standard errors clustered by	Firm	Firm
Observations	1,624	1,624
R-squared	0.008	0.071
Number of companies	40	40

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4.7: Panel data regression output with added firm control variables

4.6 Event study robustness test

Following the approach of Chen et al. (2021), I decide to perform the robustness check for the event study by calculating the mean of CAARs for particular events as in section 4.1, but for the several event windows. The results are presented in Table 4.8 below:

Event window	Mean of CAARs	p-value
(-10,10)	0,7468	0,1425
(-10,2)	0,5043	0,2481
(-5,5)	0,1108	0,0010***
(-5,2)	0,0410	0,0001***
(-4,0)	0,0253	0,0006***
(-2,0)	-0,0048	0,1956
(-1,0)	-0,0013	0,0763*
(-1,+1)	-0,0004	0,6841*
(-1,10)	0,2407	0,0038***
(0,+1)	0,0006	0,6815
(0,4)	0,0507	0,0262**
(1,3)	-0,0001	0,9443
(1,4)	0,0510	0,0262**
(1,5)	0,0694	0,0059***
(1,10)	0,2420	0,0039***

*** p<0.01, ** p<0.05, * p<0.1

Table 4.8: Event CAARs calculated for several event windows

As it can be concluded based on the table above, legalization has a significant effect also in different event windows than the event window of the study (-3,3). Contrary to the results of Afik et al. (2021), I find a bigger effect after than before the event. It is worth noticing the high and significant means of CAARs in the event windows of 1 to 5 and 1 to 10.

5. Discussion and conclusions

5.1 Discussion

There are two main conclusions of the study which enrich the already existing literature. First of all, the announcement of the legalization of cannabis has a significant and negative impact on the returns of cannabis companies' stocks in the event window of the study. Secondly, the dummy variables proposed by me are not explaining the magnitude of this effect, as their impact is extremely small or not significant depending on the model used. The thesis is important from an academic perspective as nobody before analyzed the effect of the announcement of legalization on such a big sample of events and companies. The closest study is the one performed by Afik et al. (2021) who measured the effect of a company announcing entering into the cannabis-related business on the stock returns of the particular company. Based on their work I expected also the effect of legalization to be positive, but it is not true. One reason for this discrepancy may be the selected time frame of the research. Afik et al., (2021) use an event window of 30 trading days before until 60 working days after the legalization. To recall, they find the significant effect started as early as 15 trading days before the event day. However, it was the most observable during the interval from one trading day before until one trading day after the event. The explanation for the fact that the effect was noticed as early as 3 weeks before the event is the insider knowledge or earlier suggestion that such an event is going to take place. Probably, cannabis legalization is even more predictable as usually those changes are preceded by statements by governing politicians in favor of legalization, public discussions, and consultations. Therefore, it is highly probable that the new price was anticipated and absorbed much earlier than three days before the event and the very small decrease in average returns during the event window would be only the correction after a significant change. This result would be in line with the output of the study of Binder (1985) which says that the regulation changes do not cause any significant changes in stocks' returns as the change in prices are already absorbed in the prices of the stocks. Another previous study that is partially in line with my results is the one conducted by Chen et al., (2021) which conclude that the CAARs calculated for the days -1 to 10 are significant and negative in case of many events. Same conclusions can be drawn based on the analysis of the event window of my study. However, after adding more event days as I do for the robustness check, it can be observed that means of CAARs are positive starting from the four days after the event occurs. This creates a discrepancy that should be further investigated in the long-run event study. To sum up, my research does not confirm theories

that stated that legalization should lead to higher returns on cannabis companies' stocks in the closest days to legalization. Those were the theories about market expansion, investors' sentiment, and providing the access to capital. However, those aspects may affect cannabis stock returns for a longer period than the selected event study window.

5.2 Implications

The result of my thesis should be particularly interesting for investors and asset managers who consider investing their money in cannabis companies. It may be a logical conclusion that legalization should cause the returns of those stocks to increase. Moreover, on many investment websites, it can be found information about the positive legalization effects or the fact that investors should at least feel “enthusiastic” about the next legalizations.¹⁰ Therefore, my study shows that such an effect does not exist in the investigated period, and actually, cannabis stocks are characterized by on average negative returns during the closest days to the legalization. Moreover, I took into consideration the relatively big to still small size of the industry, a sample of 150 companies. Surely, the most popular and the biggest cannabis companies which are described on those websites and which are available for the majority of investors have been included. However, as was mentioned in the previous paragraph the impact of a longer period than my event window was not previously measured. It is clear that investors should not put their money in cannabis stock during the closest day to legalization date if the purchase is only caused by the hope about the positive impact of legalization on the stock price. This conclusion is contrary to what many advisors and investing websites recommend to do.

5.3 Limitations

As was written above, one of the limitations of my study is the possible impact of legalization over a longer period, before and after the event date. Therefore similar study should be done but for the long term. Another possible limitation is the fact that although all the companies are included in the cannabis industry, also this industry can be divided into subcategories like cultivation, retail, provision of equipment, research, etc. It may be possible that legalization will affect some of those subindustries differently.

¹⁰ For examples, see: <https://finance.yahoo.com/news/4-marijuana-stocks-watch-legalization-133801683.html>; <https://www.nasdaq.com/articles/7-marijuana-stocks-to-own-ahead-of-u.s.-federal-legalization-2021-07-22>

5.4 Conclusions

The purpose of the thesis is to test three research hypotheses:

- *Legalization of marijuana for medical or recreational purposes significantly affects cannabis stocks returns*
- *Medical legalization has a significantly different effect on cannabis stocks returns than the recreational one*
- *The legalization which was during the years when the number of legalizations exceeds the average was associated with statistically different cannabis stocks returns than those which happened during below the average or average years*

As it can be concluded from the results section, the first hypothesis is confirmed, as the announcement of cannabis legalization has a significant negative impact on CAARs, in case of both types of legalization. The other two research hypotheses test dummy variables which I introduce in panel data and time series models. Based on my research, as I discover that those dummies are not statistically significant or their effect is so small that they are not in practice observable, those two hypothesis needs to be rejected. The answer for the first hypothesis and especially the fact that the discovered effect is negative is important for the real world as cannabis legalization is frequently described as this which should accelerate returns from cannabis stocks. My results are contrary to this opinion and prove that it is usually not true. Moreover, it enriched the literature and opened the area for the next studies about cannabis stocks as I did not find the factors which can explain the magnitude of the effect.

6. References

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7. Appendix

Country	Legalization date	Source of legalization date
Canada	14.06.2001	https://www.canlii.org/en/ca/laws/regu/sor-2001-227/latest/sor-2001-227.html
Netherlands	01.09.2003	https://www.cannabis-med.org/index.php?tpl=page&id=235&lng=en
Czech Republic	30.01.2013	https://kopac.cz/en/current-situation-in-the-czech-republic/
Italy	23.01.2013	https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2013-02-08&atto.codiceRedazionale=13A00942&elenco30giorni=true
Uruguay	10.12.2013	https://www.tni.org/en/publication/about-drug-law-reform-in-uruguay
Jamaica	24.02.2015	https://www.tni.org/my/node/22209
Croatia	15.10.2015	https://www.efe.com/efe/english/life/croatia-legalizes-cannabis-for-medical-purposes/50000263-2738612
Chile	01.12.2015	https://es.wikipedia.org/wiki/Cannabis_en_Chile
Colombia	22.12.2015	https://www.tni.org/files/publication-downloads/policybrief_52_web.pdf --- page 8
North Macedonia	09.02.2016	https://investnorthmacedonia.gov.mk/invest-pharmaceuticals/ https://www.sec.gov/Archives/edgar/data/1697587/000147793222000142/insd_8k.htm
Australia	24.02.2016	https://www.businessinsider.com.au/medical-marijuana-is-now-legal-in-australia-2016-2
Norway	26.10.2016	https://normalnorge.no/medisinsk-cannabis/

Germany	10.03.2017	https://www.loc.gov/item/global-legal-monitor/2017-03-13/germany-medical-marijuana-act-enters-into-force/
Argentina	29.03.2017	https://www.jstor.org/stable/10.26506/pharmhist.61.3-4.0078 https://santiagotimes.cl/2017/03/30/argentina-legalizes-medical-marijuana/
Poland	22.06.2017	https://pl.wikipedia.org/wiki/Marihuana#Polska
Cyprus	26.07.2017	https://cyprus-mail.com/2017/07/26/government-approves-medical-cannabis-bill/
Greece	30.07.2017	https://prohibitionpartners.com/2017/07/26/greece-legalises-cannabis-for-medical-use/
Peru	18.09.2017	https://www.bizlatinhub.com/peru-cannabis-legalization-investment-opportunities/
Luxembourg	07.11.2017	https://delano.lu/article/delano_cannabis-medicinal-purposes-pilot-project
Denmark	01.01.2018	https://sensiseeds.com/en/blog/countries/cannabis-in-denmark-laws-use-history/
Malta	06.03.2018	https://mjbizdaily.com/malta-legalizes-marijuana-prescriptions-production-law-nears-approval/
Portugal	15.06.2018	https://www.reuters.com/article/us-portugal-health-cannabis-idINKBN1JB1X4
Vanuatu	20.09.2018	https://en.wikipedia.org/wiki/Cannabis_in_Vanuatu
Finland	01.10.2018	https://fi.wikipedia.org/wiki/Kannabiksen_lains%C3%A4%C3%A4d%C3%A4nn%C3%B6llinen_asema
Lithuania	11.10.2018	https://china-cee.eu/wp-content/uploads/2018/11/2018s1043%EF%BC%8810%EF%BC%89Lithuania.pdf

New Zealand	11.12.2018	https://www.parliament.nz/en/pb/bills-and-laws/bills-proposed-laws/document/BILL_75877/misuse-of-drugs-medicinal-cannabis-amendment-bill
Saint Vincent and the Grenadines	11.12.2018	https://mjbizdaily.com/first-medicinal-cannabis-licences-granted-in-st-vincent-and-the-grenadines/
Thailand	25.12.2018	https://www.cnbc.com/2018/12/25/thailand-approves-medical-marijuana-in-new-years-gift.html
Zimbabwe	27.12.2018	https://en.wikipedia.org/wiki/Cannabis_in_Zimbabwe
Ireland	26.06.2019	https://www.gov.ie/en/publication/90ece9-medical-cannabis-access-programme/
Ecuador	17.09.2019	https://gvn.com.ec/2020/10/26/normativa-y-oportunidades-del-cultivo-de-cannabis-en-ecuador/
Barbados	27.11.2019	https://mjbizdaily.com/barbados-medical-cannabis-law-clears-final-hurdle-in-parliament/
Zambia	16.12.2019	https://www.lusakatimes.com/2019/12/26/the-legalization-of-marijuana-for-medicinal-and-commercial-use-is-the-right-way-to-go/
Malawi	27.02.2020	https://www.timeslive.co.za/news/africa/2020-02-28-malawi-legalises-cannabis-for-medicine-and-industrial-fibres/
Lebanon	21.04.2020	https://www.fortunejournals.com/articles/medical-cannabis-in-lebanon-history-amp-therapeutic-ethical-and-social-challenges-a-narrative-review.html

Morocco	26.05.2021	https://www.moroccoworldnews.com/2021/05/342612/moroccos-house-of-representatives-adopts-bill-on-legal-use-of-cannabis
Rwanda	25.06.2021	https://www.ktpress.rw/2021/06/rwanda-moves-closer-to-mass-production-of-cannabis-following-approval-of-new-law/
Panama	13.10.2021	https://www.lexology.com/library/detail.aspx?g=d9e51933-5b33-4bb6-8d0e-de32a699cb3e
Brazil	23.02.2015	https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra;jsessionid=node01vstr0jr2h1es9r68blsy6yh22291316.node0?codteor=2027392&filename=Avulso+-PL+399/2015
Switzerland	19.03.2020	https://www.loc.gov/item/global-legal-monitor/2021-04-22/switzerland-access-to-medical-cannabis-broadened-pilot-projects-for-nonmedical-cannabis-to-be-launched/

Table 1: Legalization dates of medical cannabis by countries

State/inhabited territory	Legalization date	Source of legalization date
California	05.10.1996	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Alaska	03.10.1998	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Oregon	03.10.1998	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Washington	03.10.1998	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Maine	02.11.1999	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Colorado	07.11.2000	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Hawaii	14.06.2000	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Nevada	07.11.2000	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Montana	02.11.2004	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Rhode Island	03.01.2006	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
New Mexico	13.03.2007	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Michigan	04.11.2008	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
New Jersey	11.01.2010	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc

Arizona	02.11.2010	https://ballotpedia.org/Arizona_Medical_Marijuana_Question,_Proposition_203_(2010)
Delaware	13.05.2011	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#delaware
Connecticut	01.07.2012	https://norml.org/news/2012/06/07/connecticut-medicinal-marijuana-legalization-measure-signed-into-law/
Massachusetts	06.11.2012	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Illinois	17.05.2013	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
New Hampshire	26.06.2013	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Maryland	08.04.2014	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Vermont	26.05.2014	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
New York	20.06.2014	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Virginia	26.02.2015	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Pennsylvania	13.04.2016	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Louisiana	16.05.2016	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Ohio	25.05.2016	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida
Arkansas	08.11.2016	https://en.wikipedia.org/wiki/Cannabis_in_Arkansas#cite_note-tfw-15
Florida	08.11.2016	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/#florida

North Dakota	08.11.2016	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
West Virginia	19.04.2017	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Oklahoma	26.06.2018	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Missouri	06.11.2018	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Utah	06.11.2018	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
South Dakota	03.11.2020	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Alabama	17.05.2021	https://www.regulatoryoversight.com/2022/02/the-status-of-cannabis-legalization-in-the-south/
Mississippi	26.01.2022	https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc
Minnesota	15.05.2014	https://www.mpp.org/states/minnesota/minnesota-a-medical-marijuana-law-overview/
Guam	04.11.2014	https://www.rnz.co.nz/international/programmes/datelinepacific/audio/20152999/guam-voters-prepare-for-referendum-on-medicinal-marijuana
Northern Mariana Islands	30.08.2018	https://www.cannabisbusinesstimes.com/article/bill-legalize-regulate-marijuana-northern-mariana-islands-final-approval-legislature/
Puerto Rico	04.05.2014	https://time.com/3845638/puerto-rico-medical-marijuana/
U.S. Virgin Islands	19.01.2019	https://www.marijuanamoment.net/governor-signs-bill-legalizing-medical-marijuana-in-the-u-s-virgin-islands/

Table 2: Legalization dates of medical cannabis by countries

Country	Legalization date	Source of legalization date
Uruguay	10.12.2013	https://www.tni.org/en/publication/about-drug-law-reform-in-uruguay
Canada	19.06.2018	https://edition.cnn.com/2018/06/20/health/canada-legalizes-marijuana/index.html
Georgia	30.07.2018	https://www.marijuanamoment.net/georgias-high-court-removes-marijuana-possession-penalties/
South Africa	18.10.2018	https://www.cliffedekkerhofmeyr.com/en/news/publications/2018/Employment/employment-alert-20-sept-the-cannabis-judgment-implications-for-society-and-the-workplace.html
Mexico	28.07.2021	https://www.reuters.com/world/americas/mexico-supreme-court-rules-government-should-legalize-recreational-pot-2021-06-29/
Malta	14.12.2021	http://dpnsee.org/2021/12/15/malta-approves-legalisation-of-cannabis-for-personal-use/

Table 3: Legalization dates of recreational cannabis by countries

State/inhabited territory	Legalization date	Source of legalization date
Alaska	04.11.2014	https://ogletree.com/insights/alaska-voters-approve-measure-legalizing-marijuana-for-adult-recreational-use/
Arizona	03.11.2020	https://www.azcourts.gov/prop207
California	08.11.2016	https://ballotpedia.org/California_Proposition_64,_Marijuana_Legalization_(2016)
Colorado	06.11.2012	https://www.theguardian.com/world/2012/nov/09/colorado-washington-legalise-marijuana
Connecticut	17.06.2021	https://www.cga.ct.gov/asp/cgabillstatus/cgabillstatus.asp?selBillType=Bill&which_year=2021&bill_num=1201
Illinois	31.05.2019	https://abc7chicago.com/illinois-weed-legal-in-marijuana/5337346/
Maine	08.11.2016	https://legislature.maine.gov/lawlibrary/recreational_marijuana_in_maine/9419
Massachusetts	08.11.2016	https://ballotpedia.org/Massachusetts_Marijuana_Legalization,_Question_4_(2016)
Michigan	06.11.2018	https://ballotpedia.org/Michigan_Proposal_1,_Marijuana_Legalization_Initiative_(2018)
Montana	03.11.2020	https://ballotpedia.org/Montana_I-190,_Marijuana_Legalization_Initiative_(2020)
Nevada	08.11.2016	https://ballotpedia.org/Nevada_Marijuana_Legalization,_Question_2_(2016)
New Jersey	03.11.2020	https://ballotpedia.org/New_Jersey_Public_Question_1,_Marijuana_Legalization_Amendment_(2020)

New Mexico	31.03.2021	https://www.mpp.org/states/new-mexico/
New York	30.03.2021	https://nypost.com/2021/03/30/new-york-poised-to-legalize-recreational-pot/
Oregon	04.11.2014	https://ballotpedia.org/Oregon_Legalized_Marijuana_Initiative,_Measure_91_(2014)
Vermont	10.05.2017	https://www.sevendaysvt.com/OffMessage/archives/2017/05/10/vermont-house-sends-marijuana-legalization-bill-to-governor
Virginia	07.04.2021	https://www.npr.org/2021/04/07/985014557/virginia-16th-state-to-legalize-recreational-pot-latest-to-emphasize-social-equi?t=1648753331318
Washington	06.11.2012	https://ballotpedia.org/Washington_Marijuana_Legalization_and_Regulation,_Initiative_502_(2012)
District of Columbia	04.11.2014	https://ballotpedia.org/Washington_D.C._Marijuana_Legalization,_Initiative_71_(November_2014)
Guam	27.03.2019	https://www.marijuanamoment.net/guam-becomes-first-u-s-territory-to-send-marijuana-legalization-to-governor-in-2019/
Northern Mariana Islands	30.08.2018	https://www.cannabisbusinesstimes.com/article/bill-legalize-regulate-marijuana-northern-mariana-islands-final-approval-legislature/

Table 4: Legalization dates of medical cannabis by countries

Country or state	Date of legalization	Type of legalization	Number of companies used to calculate CAAR
Michigan	04.11.2008	Medical	49
New Jersey	11.01.2010	Medical	54
Arizona	02.11.2010	Medical	58
Delaware	13.05.2011	Medical	61
Connecticut	01.07.2012	Medical	68
Massachusetts	06.11.2012	Medical	74
Colorado	06.11.2012	Recreational	74
Washington	06.11.2012	Recreational	74
Czech Republic	07.12.2012	Medical	75
Italy	23.01.2013	Medical	78
Illinois	17.05.2013	Medical	79
New Hampshire	26.06.2013	Medical	79
Uruguay	10.12.2013	Medical	82
Uruguay	10.12.2013	Recreational	82
Maryland	08.04.2014	Medical	84
Puerto Rico	04.05.2014	Medical	85
Minnesota	15.05.2014	Medical	85
Vermont	26.05.2014	Medical	87
New York	20.06.2014	Medical	87
Guam	04.11.2014	Medical	91
Alaska	04.11.2014	Recreational	91
Oregon	04.11.2014	Recreational	91
District of Columbia	04.11.2014	Recreational	91
Brazil	23.02.2015	Medical	91
Jamaica	24.02.2015	Medical	91
Virginia	26.02.2015	Medical	91
Croatia	15.10.2015	Medical	99
Chile	01.12.2015	Medical	100
Colombia	22.12.2015	Medical	102
North Macedonia	09.02.2016	Medical	104

Australia	24.02.2016	Medical	104
Pennsylvania	13.04.2016	Medical	104
Louisiana	16.05.2016	Medical	105
Ohio	25.05.2016	Medical	105
Norway	26.10.2016	Medical	109
Arkansas	08.11.2016	Medical	109
Florida	08.11.2016	Medical	109
North Dakota	08.11.2016	Medical	109
California	08.11.2016	Recreational	109
Maine	08.11.2016	Recreational	109
Massachusetts	08.11.2016	Recreational	109
Nevada	08.11.2016	Recreational	109
Germany	10.03.2017	Medical	111
Argentina	29.03.2017	Medical	111
West Virginia	19.04.2017	Medical	111
Vermont	10.05.2017	Recreational	111
Poland	22.06.2017	Medical	113
Cyprus	26.07.2017	Medical	114
Greece	30.07.2017	Medical	114
Peru	18.09.2017	Medical	116
Luxembourg	07.11.2017	Medical	117
Denmark	01.01.2018	Medical	119
Malta	06.03.2018	Medical	122
Portugal	15.06.2018	Medical	123
Canada	19.06.2018	Recreational	123
Oklahoma	26.06.2018	Medical	123
Georgia	30.07.2018	Recreational	125
Northern Mariana Islands	30.08.2018	Medical	125
Northern Mariana Islands	30.08.2018	Recreational	125
Vanuatu	20.09.2018	Medical	127
Finland	01.10.2018	Medical	128
Lithuania	11.10.2018	Medical	128
South Africa	18.10.2018	Recreational	128

Missouri	06.11.2018	Medical	130
Utah	06.11.2018	Medical	130
Michigan	06.11.2018	Recreational	130
New Zealand	11.12.2018	Medical	131
Saint Vincent and the Grenadines	11.12.2018	Medical	131
Thailand	25.12.2018	Medical	131
Zimbabwe	27.12.2018	Medical	131
U.S. Virgin Islands	19.01.2019	Medical	131
Guam	27.03.2019	Recreational	136
Illinois	31.05.2019	Recreational	139
Ireland	26.06.2019	Medical	141
Ecuador	17.09.2019	Medical	145
Barbados	27.11.2019	Medical	145
Zambia	16.12.2019	Medical	145
Malawi	27.02.2020	Medical	147
Switzerland	19.03.2020	Medical	147
Lebanon	21.04.2020	Medical	148
South Dakota	03.11.2020	Medical	149
Arizona	03.11.2020	Recreational	149
Montana	03.11.2020	Recreational	149
New Jersey	03.11.2020	Recreational	149
New York	30.03.2021	Recreational	150
New Mexico	31.03.2021	Recreational	150
Virginia	07.04.2021	Recreational	150
Alabama	17.05.2021	Medical	150
Morocco	26.05.2021	Medical	150
Connecticut	17.06.2021	Recreational	150
Rwanda	25.06.2021	Medical	150
Mexico	28.07.2021	Recreational	150
Panama	13.10.2021	Medical	150

Table 5: Number of companies that are used to calculate CAAR for particular events

Country or state	Type of legalization	Date of the event	CAAR
Michigan	medical	04.11.2008	5,8E-05
New Jersey	medical	11.01.2010	-0,0511
Arizona	medical	02.11.2010	-7,7E-05
Delaware	medical	13.05.2011	0,0002
Connecticut	medical	02.07.2012	-0,0012
Massachusetts, Colorado, Washington	recreational	06.11.2012	-0,0006
Czech Republic	medical	07.12.2012	0,0095
Italy	medical	23.01.2013	-0,0007
Illinois	medical	17.05.2013	-0,0006
New Hampshire	medical	26.06.2013	-0,0014
Uruguay	recreational	10.12.2013	-0,0018
Maryland	medical	08.04.2014	0,0085
Puerto Rico	medical	05.05.2014	-0,0016
Minnesota	medical	15.05.2014	-0,0025
Vermont	medical	27.05.2014	0,0040
New York	medical	20.06.2014	0,0061
Guam, Alaska, Oregon, District of Columbia	recreational	04.11.2014	-0,0008
Brazil	medical	23.02.2015	-0,0032
Brazil	medical	24.02.2015	-0,0029
Virginia	medical	26.02.2015	-0,0034
Croatia	medical	15.10.2015	-0,0018
Chile	medical	01.12.2015	-0,0031
Colombia	medical	22.12.2015	0,0005
North Macedonia	medical	09.02.2016	-0,0010
Australia	medical	24.02.2016	-0,0009
Pennsylvania	medical	13.04.2016	0,0069
Louisiana	medical	16.05.2016	0,0006
Ohio	medical	25.05.2016	0,0044

Norway	medical	26.10.2016	-0,0009
Arkansas, Florida, North Dakota, California, Maine, Massachusetts, Nevada	recreational	08.11.2016	-0,0001
Germany	medical	10.03.2017	-0,0028
Argentina	medical	29.03.2017	-0,0036
West Virginia	medical	19.04.2017	-0,0046
Vermont	recreational	10.05.2017	-0,0066
Poland	medical	22.06.2017	-0,0057
Cyprus	medical	26.07.2017	-0,0049
Greece	medical	31.07.2017	-0,0007
Peru	medical	18.09.2017	-0,0030
Luxembourg	medical	07.11.2017	-0,0027
Denmark	medical	02.01.2018	0,0087
Malta	medical	06.03.2018	0,0014
Portugal	medical	15.06.2018	-0,0021
Canada	recreational	19.06.2018	-0,0013
Oklahoma	medical	26.06.2018	-0,0008
Georgia	recreational	30.07.2018	-0,0013
Northern Mariana Islands	recreational	30.08.2018	-0,0006
Vanuatu	medical	20.09.2018	0,0005
Finland	medical	01.10.2018	0,0014
Lithuania	medical	11.10.2018	0,0007
South Africa	recreational	18.10.2018	-0,0015
Missouri, Utah, Michigan	recreational	06.11.2018	-0,0002
New Zealand, Saint Vincent, and the Grenadines	medical	11.12.2018	0,0009
Thailand	medical	26.12.2018	-0,0002
Zimbabwe	medical	27.12.2018	0,0005
U.S. Virgin Islands	medical	22.01.2019	-0,0007
Guam	recreational	27.03.2019	-0,0005
Illinois	recreational	31.05.2019	-0,0013
Ireland	medical	26.06.2019	0,0002
Ecuador	medical	17.09.2019	-0,0004

Barbados	medical	27.11.2019	-0,0007
Zambia	medical	16.12.2019	0,0001
Malawi	medical	27.02.2020	-0,0005
Switzerland	medical	19.03.2020	0,0015
Lebanon	medical	21.04.2020	0,0004
New Jersey	recreational	03.11.2020	-0,0017
New York	recreational	30.03.2021	-0,0031
New Mexico	recreational	31.03.2021	-0,0030
Virginia	recreational	07.04.2021	-0,0022
Alabama	medical	17.05.2021	-0,0406
Morocco	medical	26.05.2021	-0,0198
Connecticut	recreational	17.06.2021	-0,0321
Rwanda	medical	25.06.2021	-0,0482
Mexico	recreational	28.07.2021	-0,0793
Panama	medical	13.10.2021	-0,2540

Table 6: Calculated CAARs for every event day

Company name	P-value	CAAR	Nationality
1933 Industries Inc.	6,92E-05	-0,0014***	Canada
22nd Century Group Inc.	0,8142	0	USA
Acreage Holdings Inc.	0,0744	-0,0012*	USA
Affinor Growers Inc.	7,96E-16	0,0053***	Canada
Agra Ventures Ltd	0,7210	-0,0083	Canada
Akerna Corp.	0,6951	0	USA
Aleafia Health Inc.	5,90E-05	-0,0014***	Canada
Aphria	0,1563	0	Canada
Applied BioSciences Corp.	0,3307	-0,2724	USA
Aurora cannabis	0,6906	0	Canada
AusCann Group Holdings Ltd	8,72E-35	0,0043***	Canada
Australis Capital, Inc.	0,0605	-0,0012*	USA
Auxly Cannabis Group Inc.	0,0554	-0,0019*	Canada
AXIM Biotechnologies Inc.	0,7864	-0,0018	USA
Ayr Wellness, Inc.	0,6702	0	USA
Belgravia Hartford Capital Inc.	0,7717	0	Canada
BetterLife Pharma Inc.	0,2747	-0,0065	Canada
BlissCo Cannabis Corp.	0,3259	0,0076	Canada
Body & Mind Inc.	0,9775	0	Canada
Can B Corp.	6,61E-28	0,0068***	USA
Cann Group Limited	0,3486	0	USA
Cannabics Pharmaceuticals Inc.	4,46E-05	-0,0029***	USA
Cannabis Sativa, Inc.	0,0333	-0,0019**	USA
Cannabis Strategic Ventures	0,6294	0	USA
Cannabix Technologies Inc.	0,4877	0	Canada
CannaGrow Holdings, Inc.	2,37E-26	-0,0113***	USA
CannPal Animal Therapeutics Limited	0,6214	0	USA
Canntab Therapeutics Limited	0,0005	-0,0022***	Canada
CannTrust Holdings Inc.	0,3136	-0,7952	USA
Canopy Growth Corporation	0,2532	0,0144	Canada
Captor Capital Corp	0,0051	-0,0078***	Canada
Cara Therapeutics Inc.	0,0719	0*	USA

CBD of Denver, Inc.	0,6748	-0,0056	USA
cbdMD, Inc.	0,1067	0	USA
Chalice Brands	0,5084	0	Canada
Chemesis International, Inc.	0,3866	0,0014	Canada
Chemistree Technology Inc	0,3407	0	Canada
Choom Holdings Inc	1,22E-53	-0,0141***	Canada
CLS Holdings USA Inc	0,2191	-0,0016	USA
Columbia Care, Inc.	0,0305	-0,0012**	USA
Corbus Pharmaceuticals Holdings Inc	0,6071	0	USA
CordovaCann Corp.	0,9623	0	USA
Cresco Labs Inc.	0,0008	0,0035***	USA
Creso Pharma Ltd	0,198	0	Canada
Cronos Group Inc	9,99E-09	-0,0026***	Canada
Curaleaf	0,6958	0	USA
CURE Pharmaceutical Holding Corp.	0,4317	-0,0117	USA
CV Sciences, Inc.	0,3300	0,0017	USA
Delta 9 Cannabis, Inc.	0,1444	0,0035	Canada
Diego Pellicer Worldwide, Inc.	0,0021	-0,0096***	USA
DionyMed Brands, Inc.	0,3562	0	Canada
Earth Science Tech, Inc.	0,0433	-0,0023**	USA
Eastwest Bioscience, Inc.	2,09E-13	-0,0024***	Canada
Eat Well Investment Group Inc	0,7655	0	Canada
Elixinol Wellness Ltd	0,0056	0,0012***	Canada
Emerald Health Therapeutics Inc.	0,0418	0,0046**	Canada
Eve & Co.	0,6419	0	Canada
EVIO, Inc.	0,0026	-0,0015***	USA
FinCanna Capital Corp.	1,98E-42	-0,0066***	Canada
Flower One Holdings, Inc.	0,7830	0	Canada
FSD Pharma Inc.	1,96E-05	-0,0024***	Canada
Future Farm Technologies Inc	0,3736	-0,0058	Canada
GB Sciences Inc.	0,1274	-0,0046	Canada
General Cannabis Corp.	0,0005	-0,0013***	USA
Global Cannabis Applications Corp	2,21E-07	-0,0024***	Canada

Global Health Clinics Ltd	4,06E-37	0,0269***	Canada
Green Growth Brands, Inc.	0,9852	0	Canada
Green Thumb - return	0,0037	0,0016***	USA
GreenGro Technologies, Inc.	0,0259	-0,0019**	USA
GrowGeneration Corp.	0,0041	0***	USA
GrowLife, Inc.	0,0052	-0,0015***	USA
Grown Rogue International Inc.	1,71E-07	0,0015***	Canada
GW Pharmaceutical	0,4547	-0,0034	USA
Harvest Health & Recreation Inc.	0,0904	-0,0013*	USA
Harvest One Cannabis, Inc.	0,8877	0	Canada
Hemp, Inc.	1,43E-14	0,0052***	USA
Hempco Food and Fiber Inc.	0,0175	-0,0018**	Canada
Heritage Cannabis Holdings Corp	0,5846	0	Canada
HEXO Corp.	2,42E-108	-0,1251***	Canada
High Fusion Inc.	0,1647	0,0016	Canada
High Tide Inc.	5,77E-25	-0,059***	Canada
Hill Street Beverage Co	0,0004	-0,0016***	Canada
iAnthus Capital Holdings, Inc.	0,5316	0	USA
ICC International Cannabis Corp.	0,9095	0	Canada
IM Cannabis Corp	0,1561	0	Canada
India Globalization Capital	1,38E-19	-0,0056***	USA
Indiva Ltd.	0,0182	-0,0013**	Canada
InMed Pharmaceuticals Inc.	0,3043	0	Canada
Innovative Industrial Properties	0,0495	0**	USA
Insys Therapeutics, Inc.	3,27E-11	-0,0014***	USA
Integrated Cannabis Solutions, Inc.	0,6076	-0,0015	USA
Invictus MD Strategies Corporation	1,40E-14	-0,0636***	Canada
Isodiol International Inc	0,0004	0,0012***	USA
Item 9 Labs Corp.	0,0976	-0,0017*	USA
Kaya Holdings Inc.	4,07E-13	0,0077***	USA
Khiron Life Sciences Corp.	0,0002	-0,0068***	Canada
Koios Beverage Corp.	6,48E-05	0,0029***	Canada
Lexaria Bioscience Corp.	0,7321	-0,0136	USA

Liberty Health Sciences Inc.	9,64E-19	-0,0079***	USA
Lifeist Wellness Inc	0,0451	-0,0014**	Canada
MariMed Inc	4,37E-27	-0,0044***	USA
Marrone Bio Innovations Inc.	0,3904	0	USA
Medical Marijuana Inc.	0,0058	0,0019***	USA
Medicine Man Technologies Inc.	3,30E-70	-0,0596***	USA
MediPharm Labs Corp.	0,5177	0	Canada
MedMen Enterprises Inc.	0,2039	-0,0018	Canada
MJardin Group, Inc.	0,2985	-0,0017	USA
Mojave Brands Inc	0,3596	-0,0146	Canada
MYM Nutraceuticals Inc.	1,52E-08	-0,0032***	Canada
Naturally Splendid Enterprises Ltd	0,3044	0	Canada
Neptune Wellness Solutions, Inc	0,5214	0	Canada
NewLeaf Brands Inc.	0,3556	0	USA
Newstrike Brands Ltd.	1,11E-27	0,0058***	Canada
Next Green Wave Holdings Inc.	0,3664	0	Canada
Novus Acquisition and Development Corporation	0,0046	0,0023***	USA
OrganiGram Holdings Inc	0,3172	0	Canada
Origin House	0,6050	0	Canada
Phivida Holdings, Inc.	1,83E-05	-0,0027***	Canada
Planet 13 Holdings	0,0011	0,0013***	USA
PreveCeutical Medical Inc.	0,8603	0	Canada
Puration, Inc.	0,9445	-0,0014	USA
Pure Global Cannabis	0,6587	-0,0026	Canada
Radient Technologies Inc	1,35E-07	-0,0026***	Canada
Ravenquest BioMed Inc	0,0724	-0,0089*	Canada
Rubicon Organics Inc.	2,33E-19	-0,0169***	Canada
Sharc International Systems Inc.	4,48E-42	0,0067***	Canada
Skye Bioscience	0,6466	0	USA
SOL Global Investments Corp.	0,0416	-0,0014**	Canada
Sproutly Canada, Inc.	0,3665	0	Canada
Stem Holdings, Inc.	2,54E-28	-0,0458***	USA

Sundial Growers Inc.	0,8944	0	Canada
Sunniva Inc	0,3583	-0,1085	Canada
TerrAscend Corp.	0,0488	0,0019**	Canada
Tetra Bio-Pharma Inc.	2,27E-12	-0,0023***	Canada
The Scotts Miracle-Gro Company	4,54E-10	-0,0017***	USA
The Supreme Cannabis Company	0,2628	0	Canada
Tilray Brands, Inc.	0,0676	-0,0019*	USA
Tinley Beverage Company Inc	0,1976	0,0016	Canada
Trulieve Cannabis Corp	0,8312	0	USA
United Cannabis Corporation	0,8635	-0,0470	USA
Unrivaled Brands, Inc.	4,26E-123	-0,1237***	USA
Valens Growworks Corp.	0,9869	0	Canada
Ventura Cannabis & Wellness Corp	0,3478	-0,0060	USA
Village Farms International	0,0024	0***	Canada
VIVO Cannabis Inc.	0,6087	-0,0026	Canada
WEED Inc.	0,5663	0	USA
WM Technology, Inc. Class A	0,0465	-0,0014**	USA
Zelira Therapeutics	0,7114	0	USA
Zenabis Global Inc	7,95E-07	-0,0017***	Canada
Zynerba Pharmaceuticals	0,0006	-0,0018***	USA

*** p<0.01, ** p<0.05, * p<0.1

Table 7: CAARs calculated for every company with corresponding statistics