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Effects of Regulation Intensity on Marijuana Black Market After Legalization

by

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Abstract

Since 2012, many states and Canada have legalized the use and sale of recreational marijuana. One of the expected benefits of the legalization is that the establishment of a legal cannabis market would eliminate the black market which has been the main form of marijuana trade for decades. Even though legal options are available for marijuana producers and consumers, the black market is still thriving in states where recreational marijuana has been legalized. The reasons behind the persistence of the marijuana black market are complex. One of the main arguments is that the legalized states have failed to establish a regulatory framework which effectively keeps both producers and consumers in the legal market. Instead, strict regulations and high cost of compliance have created an environment in favor of big players while driving small-scale businesses into the black market. The current research attempts to study this issue by answering the research question of whether overregulation is pushing some marijuana businesses back to the black market or preventing them from entering the legal market.

This thesis employs a mix-method design to analyze qualitative data of news articles reporting the reasons that marijuana businesses decide to stay in the black market and a quasi-experimental time series analysis of National Incident-Based Reporting System (NIBRS) data regarding marijuana offenses in Colorado and Washington between 2014 and 2017. The qualitative analysis of news reports reveals that regulation is one of the main reasons that people stay in the illicit market. The comparison of marijuana crime trends in Colorado and Washington shows mixed findings. While marijuana offense rates in Colorado largely remained steady over the years, those in Washington increased

dramatically after the implementation of more intensive regulations. The results of this study have several policy implications for the marijuana legalization as well as implications for future research on the black-market issue.

Acknowledgments

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Introduction

Marijuana has been a prohibited substance in the United States since the federal government passed Marihuana Tax Act of 1937 (Newton, 2013). For decades, it remained a contraband under both federal regulations and the statutes of all 50 states until 1996 when voters in California started to permit cannabis use for qualified patients with certain medical conditions (California Proposition 215, 1996). In recent years, the national trend is changing from prohibition to regulating a legal marijuana market. In 2012, Colorado and Washington State first reformed their drug laws to permit the legal recreational use of marijuana. As of 2019, while medical marijuana is legal in 28 states and District of Columbia, 10 states and District of Columbia have legalized the use of marijuana for recreational purposes. Although it is still illegal on the federal level, these 10 states allow adult citizens over the age of 21 to possess small amount of cannabis and permit licensed businesses to grow, process, and sell marijuana products within their state boundaries (Berke & Gould, 2019).

In the last several years, a massive legal marijuana industry has been created in states where recreational marijuana has been legalized. For example, the most recent numbers show that Washington State has issued 1947 licenses to businesses that deal with marijuana growing, processing, retailing, or transportation. (Washington State Liquor and Cannabis Board, 2019). As of October 2018, there were 548 licensed marijuana retail stores and 287 retail product manufactures in Colorado (Colorado Department of Revenue, 2018). By April 2019, the State of Oregon has issued a total of 4326 licenses to marijuana businesses and research institutions (Oregon Liquor Control Commission, 2019). Although

the legalization only has been in effect for over a year, California has already issued over 10,000 commercial cannabis licenses (California Cannabis Portal, 2019). There is no question that the marijuana industry is growing quickly in the states where recreational marijuana is legal.

However, while the legal marijuana industry is thriving, the black market persists on a large scale in these states. Government reports and news stories show that unlicensed marijuana transactions account for a large portion of the marijuana business. A Cable News Network (CNN) report claimed that in late 2014, two years after the legalization, about 40% of cannabis transactions in Colorado were made through illegal channels (Lobosco, 2014). It also indicated that the primary cause of the black market is the high taxation on legal cannabis and the high price difference between legal and illegal cannabis products. Another news report revealed a similar situation in the Seattle area of Washington in 2016, four years after the legalization. It documented that many marijuana consumers preferred to purchase cannabis products from the black market because relatively cheaper prices and easy accessibility (Coughlin-Bogue, 2016). At the same time, Oregon's post-legalization cannabis market also included large scale illegal production and sales. In 2016, Oregon law enforcement agencies destroyed over 26,500 plants grown illegally on public lands across Oregon (Oregon-Idaho High Intensity Drug Trafficking Area, 2018). Since legalization at the beginning of 2018, the first quarter revenue from cannabis taxes in California was only one-fifth of the revenue the state projected. People in the legal marijuana business believed that the slow growth of the industry was due to the well-entrenched black market (Stagges, 2018). State-level authorities are well-aware of the situation. According to Washington State Liquor and Cannabis Board's (2018) press releases, Washington State marijuana

enforcement officers have seized multiple illegally grown or produced marijuana products in the past several years.

Advocates of marijuana legalization have been arguing that a regulated marijuana market can benefit the public by eliminating the illicit trade of marijuana and generating substantial tax revenue (Cohen & McGowan, 2012; Caputo & Ostrom, 1994; Gettman & Kennedy, 2014). However, several years after the legalization, the regulated marijuana business is yet to take over the black market in the states where marijuana is fully legalized. Certainly, some illicit marijuana production in these states is for markets in states where recreational marijuana is still illegal or even for oversea markets. But a considerable portion of the black market serves local consumers (Kaste, 2018; Stewart, 2018).

The reasons behind the persistence of the black market are complex and cover the entire marijuana business from production and distribution to consumption. Looking at this issue from the end of consumption, one possible explanation is that the high taxation on marijuana products provides opportunities for illicit production and trade because the price of marijuana on the black market is much lower than those on the legal market. Moreover, similar to the situation in alcohol and tobacco markets, underage teenage and young adult consumers also create demand for illicit cannabis as they are unable to purchase marijuana products through legal means. From the end of production and distribution, the intensive regulation intimidates aspiring marijuana businessowners because it is too demanding for them to abide the law. A variety of taxes and fees associated with regulation worsens the situation by imposing heavy financial burdens on legal marijuana businesses. Thus, they retreat to illegal trades to dodge the regulations.

In this thesis, I explore whether certain aspects of recreational cannabis legislations and regulations push some marijuana growers and retailers back to the black market or prevent them from entering the legal market. Using arrest data of marijuana offenses from Colorado and Washington State and news reports on marijuana black market in legalized states and Canada, this thesis investigates if the intensity of marijuana regulation can explain the persistence of marijuana black market after the legalization. Ultimately, this exploratory research aims to provide preliminary empirical explanations for the persistence of the marijuana black market after legalization and indicate directions for future studies on this complex issue.

Literature Review

From Prohibition to Legalization

While the exact time when marijuana was first used medically and recreationally is unknown, hemp has been used industrially in the United States since the 1600s as a common commodity. It was not until the prohibition era during the early twentieth century, federal and state governments first began to regulate the production, sale, and consumption of cannabis (Houser & Rosacker, 2014). A black market of marijuana emerged as a result of the prohibition. To study the current situation of the marijuana black market, we must first examine its prohibition and regulation, namely the evolution of the laws that prohibited or regulate marijuana use and trade.

In the early twentieth century, there was a movement in the United States to label drugs as a dangerous narcotic which eventually led to a nationwide constitutional ban on alcoholic beverages from 1920 to 1933. Although marijuana was not specifically included in the prohibition, that movement reflected a more general cultural trend toward the prohibition of any type of mind-altering substance. In 1913, influenced by concerns over the use of narcotic drugs by the state's Chinese residents, California became the first state to prohibit the use of marijuana (Houser & Rosacker, 2014). On the federal level, the Uniform Narcotics Drug Act of 1932 first included cannabis as one of the substances it intended to regulate. Shortly after, federal government adopted the Marihuana Tax Act of 1937, specifically addressing the issue of marijuana by imposing a complex system of taxation and regulation. Even though the production, sale, and consumption of cannabis

were not outlawed, people were arrested and sentenced for possession and selling marijuana on the name of violating this law (Newton, 2013).

After World War II, legislation on marijuana continued to intensify as a response to an apparent increase in drug use among young people during that period. The Boggs Act of 1951 dramatically increased penalties for drug possession and use. In this Act, marijuana, cocaine, and opiates had been included together in a single piece of federal legislation for the first time. More importantly, this legislation set up a model of drug laws that many states followed right after. Some of the state laws carried even stricter rules and severe penalties than those in the federal bill. In 1956, Congress passed the Narcotics Control Act. The key provisions of this act included even more severe penalties for the sale of and trafficking in illegal substances. As a result, marijuana prohibition was universal across the United States through the 1960s. Those who were found guilty of producing, possessing, or selling marijuana received sentences of incarceration (Newton, 2013).

Between 1937 and 1969, the Marihuana Tax Act of 1937, the 1951 Boggs Act, the Narcotics Control Act of 1956, and a cluster of state and local laws established the prohibition of marijuana. However, the U.S. Supreme Court's ruling on *Leary v. United States* in 1969 made the Marihuana Tax Act of 1937 and subsequent legislations unconstitutional on the ground of exposing an individual to self-incrimination (Newton, 2013). Consequently, the nation experienced a brief period of liberalization with the absence of federal policy regarding the use of marijuana. In the 1970s, 12 states removed or substantially reduced criminal penalties for possession of small amounts of marijuana. At the time, many observers believed that marijuana would soon be legalized (Houser & Rosacker, 2014).

However, Congress quickly began working on a new drug policy legislation. In 1970, it introduced the Comprehensive Drug Abuse Prevention and Control Act. This act comprehensively covered every aspect of drug production, distribution, registration, and consumption. Especially, Title II of the act, the Controlled Substances Act of 1970, provided the basic legislative framework for U.S. drug policy that is still in use up to today. One of the significant changes the act made on the nation's drug policy was replacing taxation as a primary mechanism of drug control with direct penalties and punishment (Newton, 2013). This feature of the act provided basis for the "war on drugs" which was introduced by President Richard M. Nixon in the 1970s and implemented nationwide during the Regan administration in the 1980s. Influenced by the new drug legislation and policy, among states where the possession of small amounts of marijuana was decriminalized, South Dakota eventually reversed its decriminalization a few years later, and no state initiated decriminalization in the subsequent twenty years (Houser & Rosacker, 2014).

In the late 1990s and 2000s, although the federal government had not changed its legislation and attitude towards cannabis, the prohibition of marijuana started to loosen on the state level. More states fully decriminalized possessing small amounts of marijuana. In addition, more than 20 states passed laws to allow marijuana to be used for medicinal purposes. While in many states, the medical-marijuana system is serving more as an adjunct to the health system than as a loophole for recreational users, a few states, such as California and Colorado, have expansive definitions of what conditions can justify obtaining a medical recommendation. Nevertheless, these developments show that the

United States had entered a new age of liberalization of marijuana policies that eventually led to the legalization of recreational marijuana in many states during the 2010s.

In 2010, a California ballot initiative that attempted to legalize recreational marijuana received 46.5 percent of the vote. Shortly after, in 2011, public opinion polls showed that over 50 percent of the population nationally favored legalizing marijuana use for recreational purposes (Swift, 2013; Hughes, 2014). Encouraged by these results, in 2012, through the passage of ballot Amendment 64 and Initiative 502 respectively, Colorado and Washington voters authorized commercial cannabis production and retail sale of recreational marijuana (Amendment 64 of Colorado, 2012; Ferner, 2012; Initiative 502 of Washington, 2012; Martin, 2012). Adults over 21 in Colorado and Washington are permitted to purchase or possess a limited amount of marijuana for personal use. While Washington does not allow home growth for recreational purposes, Colorado allows a household to grow, process, and transport up to six marijuana plants. (Amendment 64 of Colorado, 2012; Initiative 502 of Washington, 2012).

Following Colorado and Washington's footsteps, many other states also passed legislation to legalize cannabis for recreational use. Alaska, Oregon, and the District of Colombia passed Measure 2, Measure 91, and Initiative 71 respectively in 2014 (WTSP, 2017). In 2016, voters in Nevada, Massachusetts, California, and Maine also passed ballot initiatives to legalize recreational marijuana (WTSP, 2017). Michigan did the same in 2018 (Angell, 2018). In the same year, Vermont became the first state to legalize recreational cannabis by the way of state legislature as the senate passed a bill that eliminates the penalties for possessing limited amounts of marijuana by adults over 21 years old (Montpelier, 2018).

In addition to limited personal use and home growth of cannabis, the new legislation also permits licensed business to cultivate, manufacture, and sell marijuana under state regulations. The production and retail of recreational marijuana soon began after the legislations took effect. On July 8, 2014, the first recreational cannabis dispensary was opened in Washington (Johnson, 2014). Oregon Liquor Control Commission issued the first license to a recreational marijuana producer in April 2016 and the first retail license in October (Crombie, 2014). Legal sales also began in Nevada and Massachusetts in 2017 and 2018 (Lochhead, 2017; Bartlett, 2018). State-sanctioned marijuana businesses, including cannabis growing, processing, transportation, and retail launched in California at the beginning of 2018 (Staggs, 2017). As of 2018, a legal marijuana market had been created in many states across the United States. Individuals living in these states who are 21 and older can purchase cannabis legally at licensed stores and apply for licenses to produce, process, transport, and sell recreational marijuana.

At the same time, the legalization of marijuana also has become a global trend. While many countries across the world are legalizing medical marijuana and decriminalizing recreational use, on October 17, 2018, Canada became the second country in the world to fully legalize marijuana following Uruguay (Bilefsky, 2018). This change made Canada the single largest legal marijuana market in the world.

Regulations and Black Market

The definition of marijuana black market changed overtime with the evolvement of drug laws. In general, it refers to illicit production, trade, and use of cannabis in violation

of the laws and official regulations. Until the legalization of recreational marijuana in recent years, any activity related to cannabis production, sale, and consumption had to operate in the black market except those for medical purposes sanctioned by state laws. The legalization has significantly reduced the scope of cannabis black market as many types of activities regrading marijuana have been included in the legal framework. It also marks a line between the legal and illegal markets with the law and regulation. At the same time, however, it also complicates the composition of the marijuana black market as illegal activities must be differentiated from the legal ones, even though they are conducted in the same manner. In practice, the boundary between legal and illegal transactions could become ambiguous for some people depending on their knowledge or willingness to comply with the laws and regulations. Current study focuses on a loosely defined black market that consist of all the cannabis production and distribution that violate existing marijuana laws and regulations.

One of the main goals of marijuana legalization is to eliminate the black market by introducing a well-regulated legal market. However, evidence clearly shows that the black market in states where recreational marijuana is legal has not yet diminished entirely as expected. The reason may lay in the regulations themselves. In legalized states, the legal marijuana industry is under tight regulations. A common key provision of the ballots legalizing recreational marijuana is to establish a system, overseen by state government, to set out regulations and taxation for marijuana retail businesses. For example, California's Proposition 64 asks the state government to establish standards and restrictions for packaging, labeling, advertising, and marking marijuana products (California Proposition 64, 2016). Although state-level regulations for legal marijuana producers and retailers vary

in detail, they usually focus on several main categories including licensing, production and distribution limits, packaging and labeling regulations, the installation of tracking and security systems, advertising, and taxation. Each marijuana business establishment must meet certain requirements in order to acquire a license from the regulatory agency. More importantly, these regulations are very detailed and oftentimes strict. For instance, in Washington State, marijuana production must take place (1) within a fully enclosed secure indoor facility or greenhouse with rigid walls, a roof, and doors; or (2) outdoors in nonrigid greenhouses, other structures, or an expanse of open or cleared ground fully enclosed by a physical barrier at least eight feet tall (Washington State Liquor and Cannabis Board, 2018).

Moreover, these regulations sometimes impose heavy financial responsibilities to legal marijuana businesses and their products, including license fees, testing fees, insurance, and taxation. To open a new retail marijuana store in Alaska, the business owner needs to pay a $1,000 application fee and a $5,000 annual license fee (Alaska Department of Commerce, Community, and Economic Development, 2018). The so-call "sin tax" on marijuana is usually heavy. Colorado has 15% excise tax from marijuana cultivation to processing or retail while this kind of tax is 25% in Washington State at each stage of sales (from producer to processor to retailer to customer) (Colorado Department of Revenue, 2018; Washington State Liquor and Cannabis Board, 2018). In practice, the overall tax rate on cannabis products is much higher. In California, for example, it could be as high as 45%, including a 15% state excise tax, state cultivation taxes of $9.25 per ounce for cannabis flower and $2.75 per ounce for leaves, as well as state and local sales taxes currently ranging from 7.75% to 9.75% (The Bond Buyer, 2017).

These intensive and strict regulations and taxations reflect legislators' caution on opening the legal cannabis market and their intention to closely regulate the production and use of marijuana. But it also may be one of the main reasons behind the persistence of the black market in states where recreational marijuana has been legalized. For instance, some observers have already begun to argue that heavy financial and tax burdens on marijuana businesses may "complicate such [increased enforcement] efforts by diverting in-state sales to the black market" (The Bond Buyer, 2017). Some academic studies also raise similar arguments. Caulkins et al. (2014) indicate that price is a major factor contributing to black market activities encouraged by excessively high taxation, expensive regulatory compliance, variation between medical and recreational costs, and the lack of ability to deduct legitimate business expenses. In discussing possible issues associated with legalization, Caulkins (2014) points out that the current marijuana legislation favors large for-profit companies and warns us about the dangers of corporate takeover of the legal marijuana market. This trend would only prevent legal cannabis to replace the black market.

Regulation Intensity and Black Market

Although there have not been many studies focusing on the correlation between the intensity of marijuana regulations and the black market, some research provides valuable insights for the study of this subject. A case study of the local recreational cannabis supply chain in Eastern Washington, including a producer/processor, an analytic facility, and retail establishments, shows that state regulations mainly emphasize preventing diversions to the black market (Jensen & Roussell, 2016). For example, licensed cannabis growers are

prohibited from reserving even a tiny portion of their retail production for personal use. Jensen and Roussell (2016) also suggest that safety-oriented regulations, on the other hand, were shifted from the state to independent laboratories. This finding is consistent with Room (2011)'s prediction that the responsibility of controlling the safety of substances is being placed on self-regulated individuals while state's control is loosened to promote profit. Both literatures suggest that state regulations on recreational marijuana should leave room for retail marijuana establishments to gain profit and the main regulatory focus should be preventing the diversion of marijuana to the black market (Jensen & Rousell, 2016; Room, 2011).

Gettman and Kennedy (2014) identify the practice in the forgoing states as the "interventionist model," meaning marijuana trade is permitted yet access to the market is limited by government licensing. The characteristics of an interventionist model include limited market access through licensing, high levels of tax revenue, high prices, and low levels of competitions among merchants (Gettman & Kennedy, 2014). While recognizing the interventionist model is better than prohibition, the authors criticize that the controlled model would not eliminate the illegal marijuana trade. They argue that the failure of compulsory prohibition of marijuana indicates successful marijuana regulations must be able to incentive voluntary compliance. However, the interventionist model would not be able to incentive voluntary compliance because pre-legalization and small-scale marijuana producers are still shunned from the legal market. The small-scale producers would continue to produce illegally and consequently undermine the regulated marijuana market in the same way as they undermine marijuana prohibition. Meanwhile, those who can obtain licenses will make legal marijuana expensive due to the lack of competition among

legal producers and prices adjusted to reflect the high taxation. Therefore, Getteman and Kennedy (2014) argue that the high prices and lack of access will result in continuation of illicit small-scale production. The alternative recommended by Gettman and Kennedy (2014) is an open-competitive market which provides producers unrestricted access to the market with only some perfunctory regulatory requirements. In this way, many small-scale producers will be willing to join the legal market. The competition among legal marijuana businesses will substantially lower marijuana prices and incentivize voluntary compliance to market regulations.

Prior economic literatures also identify increasing regulation as one of the main causes of black-market economy (Johnson, Kaufmann, & Zoido-Lobatón, 1998; Schneider & Enste, 2000; Schneider, 2005). When comparing the magnitude of unofficial economies, Johnson et al. (1998) find countries that have fewer regulations and provide a more business-friendly environment have lower shares of unofficial economy in their countries. They find that for every one-point increase of the regulation index (ranging from 1 to 5, indicating a country with most regulation), there is an 8.1 percent increase in the share of black-market economy in the country's total gross domestic product (GDP). Schneider's (2005) study on the size of black-market economy in developing, transition countries such as Eastern Europe and Soviet Union and western countries also find consistent evidence that regulation intensity is one of the major factors that explain the size and growth of the black-market economy.

As cannabis and other controlled substances are either illegal or recently regulated, there is no direct empirical evidence on the effects of restricted licensing policies on marijuana market and what factors can explain the persistence of illicit cannabis market

after the legalization. Yet, a comparison among cannabis policies in Colorado, Washington, and Uruguay expresses the concern the strict policies adopted by Uruguay, such as regulating the amount of cannabis a person can access per year and maintaining personal information on a government registry, may encourage people to continue to seek cannabis in the criminal market (Pardo, 2014). It argues that, although the restrictive policies adopted by Uruguay may suppress the negative health consequences of marijuana legalization, they also limit the new policy's capacity of eliminating the illicit cannabis market.

Research on tobacco regulation can also shed light on the prevalence and situations of illicit transactions of substances that are legal yet subject to strict public health scrutiny. On the one hand, an examination of cigarette sales pre- and post- the anti-smoking policies in Turkey shows that increasing taxation and implementing harsher cigarette smoking regulations reduced the sales of cigarettes (Cetin, 2017). After implementing a higher cigarette taxation and more intensive public health regulations in 2004, cigarette sales drastically declined for a decade in Turkey (Cetin, 2017). Yet, as recognized by Cetin (2017), the decline of cigarette sales and the decline of people's demand for tobacco products are two different concepts. One would not be able to show the whole-picture of tobacco consumption without accounting for smuggling data or the number of people substituting cigarette with "self-rolled" tobacco products. On the other hand, another study on the topic argues that the decline of cigarette sale may also indicate a flourishing black market (Gabler & Katz, 2010). This report on the effects of anti-smoking initiatives in Canada show that, although the number of cigarette cartons sold per capita had been decreasing after the anti-smoking lobby in 2001, the increased taxation has stimulated the

growth of contraband cigarette trade, which now constitutes about 27% of the overall tobacco market in Canada. Imposing higher taxes on tobacco directly led to the emergence of a black market for contraband cigarettes. (Gabler & Katz, 2010).

In conclusion, previous literature suggests the intensive marijuana controlling policies such as high taxation and strict licensing requirements may explain why marijuana black market is still prevalent when there are legitimate channels to produce and trade cannabis. However, no study to date has specifically investigated this explanation. While recognizing the necessities of supervising, regulating, or even restricting growing, processing, and sales of marijuana to protect tax revenue, public health, and other social interests, legislators also need to be on the alert of the potential unintended consequences of restrictive marijuana-control policies—a prevalent and persistent black market. As replacing illicit cannabis transactions with regulated ones is one of the main goals of marijuana law reform, policy-makers need to be more cautious with "where to draw the line."

This thesis attempts to fill the gap in the literature by examining the relationship between the intensity of recreational marijuana regulations and the extent of illegal marijuana growing and trade. It reveals how Colorado and Washington State control marijuana establishments, the monetary and procedural costs for operating a legitim ate marijuana business, and the scope of illegal cannabis activities since the legalization. It also explores how regulation intensity impacts individual business's decision of staying in the black market for marijuana when there are legal options available. The findings of this thesis would present to policy-makers new evidence and conclusions on the unexpected consequences of implementing strict marijuana policies. Policy implications regarding how

to adjust current regulations and eliminate the black market as well as implications for future research are also provided.

Method

This thesis employs a mixed-method design to evaluate the impact of regulation intensity on marijuana black market both qualitatively and quantitatively. Specifically, I conducted a content analysis of news articles exploring why the marijuana black market still exists in states and Canada that have legalized recreational marijuana growing and retail and an interrupted time-series quasi-experiment to examine the changes of marijuana crime rates over time in Colorado and Washington State since the legalization. Adopting this congruent mixed method gives this research two methodological strengths. First, a qualitative inquiry reveals the main factors that drive marijuana growers and sellers to choose the black market rather than making their businesses legal. It generates contextual explanations for the relationship between regulation intensity and illicit marijuana activities. Second, conducting the quasi-experimental time series analysis enables me to triangulate two sets of results to examine whether the findings from data analysis support those from the content analysis of news articles.

Content Analysis of News Articles

The methodology of content analysis has been commonly used to study phenomenon in media articles (Hesse-Biber & Leavy, 2011; Kirppendorff, 2013). Although this method includes a quantitative approach of counting the numbers of occurrences of the events under study, it is essentially a qualitative strategy for identifying themes embedded in the sources that reflect a phenomenon (Mayring, 2000). A certain pattern that is common and thematic in a group of articles may imply something about the frequency, typicality, or

even intensity of a finding (Sandelowsk, 2001). Specifically, content analysis attempts to summarize common characteristics of the textual content of a number of documents by examining who says what, to whom, and with what effect (Bloor & Wood, 2006). Applying this methodology to this thesis, I examined the interviews with people involved in marijuana black market that have been documented in news reports. In doing so, I attempted to find the reasons behind their decisions to remain in the black market or not take the legal path by identifying common themes from their explanations. While the analysis was qualitative in nature, I referred to the number of articles and the number of relevant interview passages in which a particular reason was mentioned (n = X) as a way to contextualize the narratives.

Sampling

The sample consisted of 126 textual news articles published by US and Canadian media between late 2013, roughly the time when Colorado became the first state to sell legal recreational marijuana, and April 2019. The majority of articles were retrieved from several comprehensive full-text newspaper databases including InfoTrac, Newsstand, Newspaper Source, Nexis Uni, New York Times, and Wall Street Journal. In addition, a search on Google News yielded articles from a variety of digital media such as online magazines, media outlet web pages, online editions of newspapers, and blogs. The sample not only consists of news stories, but also includes other common types of news article such as columns, opinions, editorials, and blogs. Blog content was included only from those affiliated with credible sources, typically mainstream media outlets. For articles published

multiple times in difference sources, only the versions from the original sources were included. All database retrieval and sample selection were conducted by the author.

Articles were selected based on the occurrence of keywords appearing in their headlines or texts. Keywords included "marijuana black market", "marijuana illicit market", "cannabis black market", "cannabis illicit market", "marijuana legalization", and "marijuana law reforms". The sample included articles focused on the black-market situation in legalized states. Those discussing the black-market issue in Canada were also included for several reasons. First, the legalization of marijuana in Canada has drawn much attention from the media and drug policy observers. There has been a substantial amount of news articles focusing on the issues and effects of Canada's legalization, including the subject of black-market persistence. Second, Canada has similar cultural, social, economic, and legal systems to the United States. Therefore, their experience has referential significance for the study of marijuana legalization in US. While all retrieved articles referenced marijuana black market, the sample includes only articles in which it was a main focus such that the term of "marijuana black market" or similar terms appear in the headline and/or the issue is discussed in the lead paragraph or an entire section of the article text. Articles addressing the marijuana black market but fell into the following categories were excluded: those discussing the marijuana black market prior to the legalization in 2012; those discussing the marijuana black market in states or countries where recreational marijuana is still illegal; those discussing illicit activities on the medical marijuana market; those covering particular events of local law enforcement cracking down illegal marijuana operations. Most importantly, in order to be included in the sample, an article must contain interviews or direct quotes from persons participating or closely observing the marijuana

black market, such as illegal growers, sellers, or consumers as well as law enforcement officers and policy observers.

The sampled articles were selected from more than 60 unique media outlets throughout the United States and Canada, most of which yielded fewer than five articles. About 91% of the 126 sampled articles consisted of news stories (n = 110), while the rest (n = 16) are other types of media text such as column, editorial, and blogs. Regional distribution is led by articles from regional media outlets (46%, n = 58), of which those from outlets in legalized states, such as Colorado (n = 9), Oregon (n = 10), and California (n = 13), are well represented. National media outlets contribute 42% (n = 53) of the sample. Twelve percent of the articles (n = 15) are from media based in Canada. The publication time of the articles stretched from late 2013 to 2019. As Figure 1 shows, five articles were published in late 2013 when the sale of legal recreational marijuana was about to begin. In 2014, the first year of legal sale in Colorado and Washington, 19 articles raised the concern of the persistent marijuana black market and discussed this issue from different angles. The subject drew less media attention in 2015 and 2016, but there was an increase in the numbers of articles discussing the issue of the black market in the flowing years. Especially, large numbers of articles published in 2018 and 2019 because Canada, California, and several more states began the legal sale of recreational marijuana.
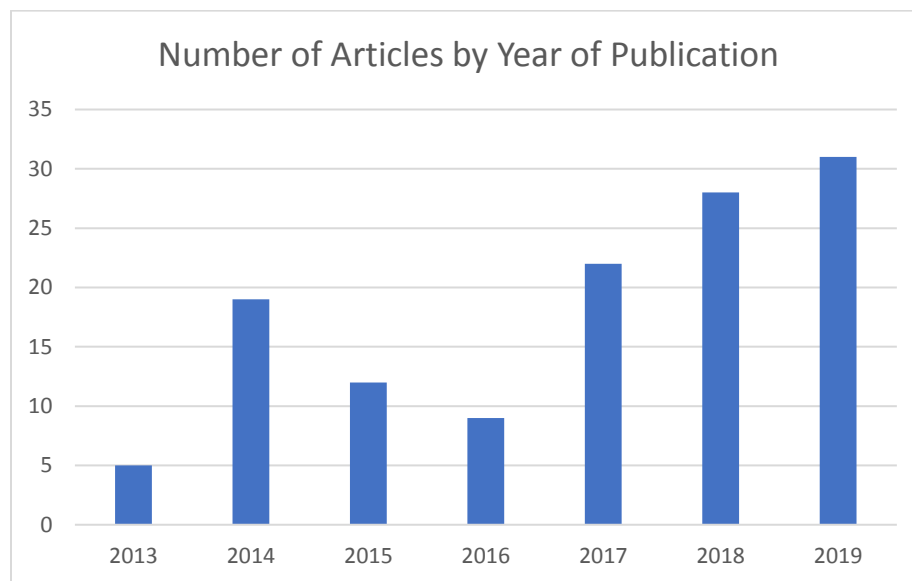
Figure 1. Distribution of News Articles by Year of Publication (2013-2019)

Analytic Plan

The date analysis was conducted in two stages. The first stage of data coding, all articles were examined and individual recording units (relevant textual passages from articles) were identified. Retrieved articles were first saved in a Microsoft Word document. Then the author conducted careful review of each article and recorded information regarding types of article, publication year, media outlet locations, geographical locations of the coverage, and interviewees' reasons for staying in the black market in the form of tally sheets. At the same time, recording units were highlighted and then recorded in a separate Word file. Keyword searches within the Word document were used to assist the reviewing process, but the majority of the work was done thorough the author's reading of each article.

The second-level analysis involved arranging and categorizing first-level recording units to identify themes. Specifically, recording units were grouped to reflect opinions

about reasons behind people's decisions to stay in or go back to the black market. For example, one grouping of recording units reflected that some marijuana growers chose to stay in the black market because of the high taxes imposed on legal marijuana businesses. Terms that frequently appeared in interviews were "high taxation" and "excessive tax". The theme of this group was labelled as "high tax" to the legal market. Recording units, in form of story headlines and text, are displayed thematically in the "Results" section below to best convey larger thematic ideas. Article headlines are presented in capital letters, while article text is quoted and/or block formatted throughout.

Interrupted Time Series Quasi-Experiment

Interrupted time series models have long been recognized as a strong quasi-experimental design for public policy research (Cook & Campbell, 1979). For large-scale public policy interventions such as legalizing recreational marijuana, it is not feasible to carry out true experiments that uses random assignments because policy changes affect the entire population. Alternatively, interrupted time series models are used to assess the impact of public policies by studying the trend of an outcome variable before and after some demonstrable intervention points (Campbell & Stanley, 1966).

Applied to the current thesis, the intervention points are the months in which Colorado or Washington significantly increased the requirements and restrictions for marijuana establishments. Specifically, Colorado announced two significant changes to marijuana regulations since the legalization. On November 23, 2015, it amended 47 existing regulations and adopted three additional requirements. For example, this version

of regulation introduced new rules regarding marijuana establishments applying to obtain financing from an indirect beneficial interest owner. All persons or business entities who wish to become an indirect beneficial interest owner of a retail marijuana establishment must to complete a rather complex application process and to be qualified by the authority. It also added detailed rules regarding retail marijuana transporters to the previous version that ranged from prohibited acts to the requirement of inventory tracking system to health and safety regulations. There were also changes in many other areas. On January 1, 2017, the Colorado legislature again revised 41 regulations and added 13 new ones. For instance, this version introduced an entirely new set of rules regarding labeling and packaging. It established requirements for packaging and labeling all containers immediately containing retail marijuana flower and trim, marijuana concentrate and other types of marijuana product. It required each label on a container to show a series of information of the product's history, such as the cultivator's license number, the harvest batch number, manufacturer's license number, the net contents of the product, and potency test results. Detailed rules such as font size, use of English language, and the use of prohibited statements and phrases were also included. The 2017 version also introduced some new rules regarding containment testing. It established that cultivation facilities and manufacturers that produce retail marijuana, marijuana concentrate, or other types of marijuana product should at least send one of their harvest batch to all contaminant testing within every 30 days.

In Washington State, a significant marijuana regulation change was approved by the legislature on May 18, 2016 and executed on June 18, 2016. The changes included modifying 51 existing requirements and adding 12 new rules. One of the most important

changes implemented was the application process. The new regulations require all applicants to notify the public about their applications on the outside of the premises to be licensed. It also established a priority system to determine the order that marijuana retailers are licensed. Applicants who were operated or were employed by a collective garden prior to January 1, 2013, have maintained a state business license and municipal business license, and have had a history of paying all applicable state taxes and fees were given priority status. The new version also introduced a set of requirements for quality assurance in addition to the existing ones. For example, all producers and processors must provide samples of their products to certified third-party laboratories for tests in order to ensure quality assurance following the detailed sampling protocols provided. Although there were other amendments or new policy implementations between 2014 and 2017, they do not constitute significant regulatory changes because only a small number of regulations were modified, or regulations were only modified slightly.

Therefore, November 2015 and January 2017 were selected as intervention points for Colorado and June 2016 was selected as an intervention point for Washington State. These intervention points represent the month in which Colorado or Washington experienced a significant policy change that substantially increased the intensity of regulations for licensed marijuana businesses and potential licensees in two states. The hypothesis is that marijuana offense rates will increase after the implementation of new sets of regulations.

Data and Measurement

The analysis utilized National Incident-Based Reporting System (NIBRS) data between 2014 to 2017 to measure marijuana offense rates before and after significant regulation changes. For 2014 to 2016 NIBRS data, monthly drug/narcotic-violation (primary suspected drug is marijuana) arrest rates per 100,000 population in Colorado and Washington were calculated in the following steps to measure marijuana offense rates: (1) Colorado and Washington NIBRS data was selected from the national database obtained from the Institute for Social Research at the University of Michigan (ICPSR); (2) for each state, drug/narcotic crimes were selected using incidents that had the value of 351 (drug/narcotic violations) for the variable named UCR offense Code-1; (3) drug/narcotic crimes that had the value of 5 (marijuana) for the variable named Suspected Drug Type 1-1 was further selected; (4) the total number of marijuana offenses in each month obtained in step 3 was used to calculate the monthly crime rates per 100,000 population.

2017 NIBRS data was recently released at the time of this thesis and not yet available on the ICPSR website. Therefore, the data was obtained from Federal Bureau of Investigation (FBI)'s website instead. However, marijuana offenses rates were calculated in a different way because data acquired from FBI's website had not been aggregated into a master file. It contained a number of smaller files, each reporting a key component of the NIBRS data such as the type and quantity of suspected drug or the date and status of each incident. Moreover, none of the individual smaller files provided sufficient information for the interrupted time series analyses because each of them only contained partial information regarding the incidents. For example, files entitled "suspected drug" provided information on the type and quantity of reported drugs but did not indicate when the

incidents occurred and the associated types of offenses. Therefore, 2017 marijuana offense rates were calculated differently through the following steps: (1) Colorado and Washington data were downloaded from FBI's website; (2) For each state, files entitled "property" and "suspected drug" were merged into one file to find the corresponding incident ID for each drug related offense; (3) crimes associated with marijuana violation were selected manually from data created in step 2; (4) information of incident date was added to the data created in step 3 by merging it with files entitled "incidents"; (5) data created in step 4 was merged with files entitled "offense" to identify the type of crime of each incident; (6) cases that are identified as drug/narcotic violations (offense type value =16) were selected from the data created in step 5; (7) the total number of marijuana offenses in each month obtained in step 6 was used to calculate the monthly crime rates per 100,000 population.

A preliminary analysis showed the number of law enforcement agencies in Colorado and Washington reporting to NIBRS from 2014 to 2017 was very similar across these years and almost every agency reported all 12 months. 2014 to 2017 were selected because licensed marijuana retail in both states started in 2014 and 2017 is the most recent year that has data available. For Washington State, only arrests reported after July 2014 were included in the analysis because this was when marijuana retail first started in the state. The Colorado data started in January 2014 for the same reason. Pre-legalization data was not included in the analysis as all activities involving production, distribution, and consumption of recreational cannabis were considered illegal at the time. Therefore, marijuana crime rates were expected to be different before and after the legalization regardless of regulation intensity due to the different nature of marijuana transactions.

Analytic Plan

The interrupted time-series modeling method adopted in the current thesis is the single group Interrupted Time-Series Analysis (ITSA) approach described by Linden (2015). This is a robust approach to estimate treatment effects for a single treatment group, a multiple group comparison, or when multiple sequentially interventions were introduced (Liden & Arbor, 2015). For this research, I chose to use single group ITSA to estimate the single treatment effect that occurred in Colorado and Washington due to the current situation of marijuana legislation in the United States. It is not feasible to construct comparison groups to estimate the magnitude of marijuana black market or changes of patterns in marijuana illegal activities because all marijuana-related transactions are illegal in states where recreational marijuana has not yet been legalized. Moreover, due to the different intervention points identified in Washington and Colorado regulation changes, the treatment effects in two states were measured separately.

As described in detail by Linden (2015), the single group interrupted time-series model is defined as follows:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 X_t T_t + \varepsilon_t$$

Yt is the outcome variable measured at each time period t, T_t is the number of months that have passed since the initial measurement, and X_t is a dummy variable indicating either prior to the intervention ($X_t = 0$) or after the intervention ($X_t = 1$). $X_t T_t$ is an interaction term of X_t and T_t. β_0 represents the intercept of the outcome variable. β_1 represents the slope of the outcome variable prior to the intervention. β_2 represents the slope of the outcome variable after the intervention. A significant β_2 indicates an immediate

treatment effect after the intervention. β_3 represents the difference between the pre-intervention slope and the post-intervention slope. A significant β_3 indicates a significant treatment effect over time after the intervention. The natural interruption point used for this thesis is the month in which a significant change in marijuana regulation intensity was executed—November 2015 and January 2017 for Colorado and June 2016 for Washington. The interrupted time series models are estimated in STATA using the ITSA package (Linden, 2015). After each model, autocorrelation is tested using the ACTEST package (Linden, 2015; Baum & Schaffer, 2013).

Results

Although the production, distribution, and consumption of recreational marijuana have been permitted in Colorado and Washington since 2014, illegal marijuana-related activities still exist in two states. Table 1 presents the number of marijuana offenses reported by Colorado and Washington law enforcement agencies each year and the annual marijuana crime rates per 100,000 population from 2014 to 2017. In these years, fewer people are arrested in Washington State than in Colorado. In Colorado, there were more than 100 marijuana crimes per 100,000 residents in 2014 and 2015. Crime rates gradually decreased to less 100 incidents per 100,000 residents in 2016 and to about 80 incidents per 100,000 population in 2017. Marijuana crime rates in Washington State remain relatively steady but increased gradually. In 2014 and 2015, the marijuana crime rates per 100,000 residents were both at around 26. This number was increased to more than 28 incidents per 100,000 residents in 2016. In 2017, a total of 2,628 marijuana crimes were reported by law enforcement agencies in Washington, making the annual crime rates 35.96 per capita.

Table 1. Annual Marijuana Crimes in Colorado and Washington State

	Colorado		Washington State	
	Number of arrests reported	Arrest rates per 100,000 residents	Number of arrests reported	Arrest rates per 100,000 residents
2014	5,692	109.51	1,824	26.18
2015	5,668	107.37	1,854	26.26
2016	5,255	98.05	2,014	28.04
2017	4,368	80.35	2,628	35.95

Content Analysis of News Articles

The news articles collected indicate a variety of reasons that lead to marijuana businesses' decisions to stay in or go back to the black market in legalized states and Canada. While the majority of the interviewees in these articles only stated a particular reason that had caused themselves or others to stay in the black market or being reluctant to enter the legal market, some of them mentioned multiple reasons. During the review of the articles, the author identified a total of 169 recording units, each of which contains a single reason stated by an interviewee. Through thematic analysis, these reasons can be categorized into three broad themes: regulation, market situation, and the persistence of traditional illegal producers.

First, a large number of the recording units from the sample show that strict regulations and the high cost associated with the compliance are the main factor that has driven people, particular small growers and sellers, into the black market. Over two third of recording units (68%; n = 115) contain interviews and quotations from black market participants stating this reason. Terms such as "overregulation", "cost of compliance", "high taxes" are frequently used in the headlines and texts to describe "barriers" for "small producers" to enter the legal market or "drive" them to the black market.

For example, a recent news story about Oregon's marijuana market recorded how small marijuana growers were struggling with keeping their legal businesses going while trying to fulfill state's regulatory requirements (O'Neill, 2019). Marijuana farmers who were interviewed by the author believed that some of the rules created to prevent drug trafficking were fueling the migration to the black market. Particularly, these farmers complained about the requirement to install expensive security camera system and

marijuana tracking system that require them to log every "seed-to-sale" transaction. Also, strict distribution rules made it time-consuming and pricey to get their products into shops. Many of them began to sell their products to the black market for a higher profit in order to cover the cost of compliance. A farmer called Getlin said: "The cost of compliance is astronomical." (O'Neill, 2019) Another farmer made a general comment on the situation, said:

> Four years ago, you had old-time growers decide, 'OK, I don't want to buck the system anymore, I'm going to go legal,'" Morse said. "For these guys, a lot of the compliance is a major pain in the ass … The regulatory hoop-jumping simply didn't pay off for some farmers. So they got creative.

While the increasing regulations and associated cost are pushing small legal players to the black market, they also set up barriers to keep potential legal business owners, most of whom are veterans of the black market, out of the legal market. An article that discusses the marijuana black market in California specifically address this issue (Staggs, 2019). Several interviewees in this article expressed their concern that there was no pathway to get licensed due to a number of regulatory restrictions such as tight local control, zoning rules, and high license fees. Casey O'Neill, a longtime Mendocino County cannabis farmer and a board member of the California Growers Association trade group, said:

> There are thousands of people who would love to participate in the regulated market who are totally locked out… people are stuck choosing between their ethics and the need to feed their families. Those people have definitely propped up the unregulated market.

Even people who have acquired a license share the frustration of these marijuana producers. A legal delivery operator said during the interview:

> A lot of people would like to be full-on legitimate, but you have to pay rent, you have to be able to eat, so you've got to do what you've got to do. (Staggs, 2019)

The article states that there are thousands of marijuana businesses who wish to join the regulated market have stayed in the illegal market because of the lack of access. Comments about similar situation also can be found in articles discussing the black market in other legalized states. In an article discussing the marijuana black market in Massachusetts, the author points out the high cost of complying with the many state regulations that are the main factor that is keeping potential business owners to enter the legal market (Martin, 2019). A Boston legalization advocate said:

> Many people would love to get into the business, but they can't afford the lawyers, architects, and consultants needed to get a license.

Another interviewee, Joanna Varner, who has a business idea to sell cannabis-infused tea and edibles, said:

> It takes thousands of dollars just to even think about applying, unfortunately. That's not even talking about your business equipment at all…It's nearly impossible.

Not only small-scale businesses complain about the intensive regulations, but even well-financed large marijuana companies agree that it is difficult and costly to deal with them. In a 2016 article that introduced Colorado's legalization experience to Canadian audience, two successful legal marijuana establishment owners, John Lord and Tim Cullen, expressed their frustration with the overwhelming regulations and warned that overregulation would undermine the legal market (Hutchinson, 2016). Lord used his own company as an example, said

> Keeping in line with Colorado's marijuana laws is a costly headache. Wee employ 45 people in our compliance department along. Compliance regulations are the biggest barrier to entry in this business, and the toughest on the small, mom-and-pop operations. There have been141 regulatory changes in the last year along.

Cullen agreed with Lord that the regulations could be less onerous. He said:

> We have purchase limits…and pretty stringent advertising, packaging and labelling restrictions. All of our ingredients must be declared, including what's been sprayed on the plant. The bar is set high.

Instead of generally addressing the issue of regulation, many recording units (n = 34) focus on a specific aspect of the regulation—tax. They discuss the issue of high taxes imposed on legal marijuana and argue that it is a main factor that drives people, both producers and consumers, to the black market. In these articles, terms such as "high" and "excessive" are frequently used to describe the taxes that consumers must pay for retail marijuana and legal businesses have to pay. Interviews in these articles believe that the high taxation is the main reason that drives consumers and producers back to the black market. For example, in an article covering the black market in Colorado, a marijuana legalization activist criticizes Colorado's marijuana taxes as "an overreach and excessive" (PBS, 2014). In another article, analyst John Kagia argues that the high taxes on legal marijuana drive users back into the black market (Elliott, 2017). This situation in turn creates a huge demand for illicit marijuana, which further draws producers back into the black market. He said:

> If taxes increase the price of cannabis beyond a certain point, the legal market becomes less competitive than the illicit market and then consumers become less likely to make the transition from the illicit market to the legal market.

The authorities also have realized that high taxation contributes to the persistence of the black market. In an article specifically discussing the taxes imposed on cannabis production and retail sales, Colorado's Department of Revenue stated:

> It is our position that excessive taxation … has the potential effect to keep a black market for marijuana alive in Colorado. (Denver Post, 2013)

Another article recorded an Oregon lawmaker's comment on Washington State's high marijuana taxes, said:

> Prices in Washington state are sky high because of high taxes. That's a mistake we shouldn't make because it allows the black market to continue to thrive. (Hubbard, 2015)

Although high taxation is a sub-category of the overall regulation, some policy observers think high taxes are as important as overregulation as a reason for keeping small operations out of the legal market. In an article interviewing Professor Seth Crawford, a sociologist and an expert on marijuana legalization policy from Oregon State University, he states that the high tax rate on legal contributes to financial burden of cost of compliance that prevents small-scale producers from entering the legal market (Oregon State University, 2014). He said:

> Setting a high tax rate or imposing hefty capital requirements could serve as barriers for current small-scale marijuana producers to enter the legal market, Crawford said. In Washington state, the requirements to obtain a permit were so stringent that many were shut out of the market.

A Denver lawyer, Rober Corry, who helped to write Colorado's marijuana legalization measure share the same view with Professor Crawford (Gurman, 2014). He said in an interview:

> Those barriers to entry already create the potential for the black market, and then you add these taxes on top of it, and it makes it impossible to get rid of.

In addition to high taxation, several articles also discuss some other specific regulations that keep potential legal marijuana business owners out of the legal market. For example, many long-term marijuana producers have criminal records due to their activities prior to the legalization. With no access to the legal market, these people are most likely to

continue to produce marijuana illegally. An unlicensed marijuana grower in Colorado expressed his opinion on this issue during his interview with a reporter, said:

> There's a lot people that have broken the law that are great entrepreneurs, work very hard, ha good work ethics, family values, good communication skills. I mean, I definitely believe that they should be given a chance. The rules and regulations should allow a good grower that's been in trouble to do this. (PBS, 2014)

More importantly, several articles include interviewees' criticism against the regulatory systems that have been set up by legalized states, arguing that the intensive regulations give advantages to well-financed big players and keep small businesses out of the legal market. Professor Seth Crawford, for instance, addressed this issue in his interview, said:

> It's these small producers who have the most to lose in the policy development process," Crawford said. "If they're unable to participate in the legal market, marijuana legalization could result in increased economic inequality... (Oregon State University, 2014)

Larisa Bolivar, a former medical marijuana legalization activist in Colorado, also believes that the current regulatory system of legal marijuana causes socio-economic inequality (PBS, 2014). During her interview with the report, she said:

> It's classist. The regulations support those that have access to wealth. And middle and lower classes don't have access to wealth. I can't just go and ask my dad, "Hey, can I have $20,000 for licensing and application fees?" You know? And then "Can I get a million dollars to get a property?"

Ms. Hopkins, who is the Sonoma County supervisor, criticize California's current regulatory system of legal marijuana very harshly (Fuller, 2019). She believes that the overregulation is in favor of well-financed large companies. She said:

> In California we've done what we always do—regulate, regulate, regulate, which ultimately gives significant advantage to large companies with significant economies of scale.

A marijuana market analyst, Tom Adams, summarize this situation during an interview, said:

> The effort to protect the little guy is ultimately doomed. The retailers are going to have to get big or get out. (Fuller, 2017)

Second, market situation is another broad reason that causes people to stay in or go back to the black market. Since legalization, the price of marijuana has gone down significantly because of more production. The legal industry in many states, particularly those in the West, has been facing the issues with oversupply and low price. Growers were forced to sell their product for a loss or destroy their marijuana that they could not sell according to the regulations. This situation made some growers take the risk to sell their yield to local black markets or out-of-state black market. About 13% of the recording units (n = 22) address this issue. Frequently used terms in the articles include "overproduction", "oversupply", "low supply," "falling prices", and "out-of-state".

Although many states have experienced this problem continuously or periodically, Oregon has been a typical example. Since it opened the legal market in 2015, Oregon's legal marijuana production saw a rapid and dramatic growth. The state's legal marijuana industry soon faced a problem of unbalanced demand and supply ratio due to the overproduction. For instance, between July 2017 and June 2018, Oregon Liquor Control Committee (OLCC) estimated the statewide demand in recreational marijuana market was only 50% of supply produced by OLCC-licensed producers (Oregon Liquor Control Committee, 2019). Consequently, the price of marijuana dropped to a very low point. This "high supply and low price" market disruption has caused the increase of illegal marijuana activities in Oregon. Many legal producers began to sell their product to out-of-state

customers to cover their losses on the legal market. As early as 2015, state representative

Andy Olson has observed:

> We're currently a pipeline to many other states of black-market marijuana.
> That excess production is a problem. (Hubbard, 2015)

This market situation continued in the next several years. In 2018, Billy Williams,

U.S. Attorney for Oregon, commented on the overproduction issue in relation to the black

market, said:

> What is often lost in this discussion is the link between marijuana and
> serious, interstate criminal activity. Overproduction is rampant, and the
> illegal transport of product out-of-state — a violation of both state and
> federal law — continues unchecked. (Flaccus & Foody, 2018)

Similarly, Josh Lehner, an economist who works for the state government of Oregon,

said in March 2019:

> The current situation creates a concern that [legally grown cannabis] may
> be diverted to the black market and/or out of state given current market
> conditions (high supply, falling prices, and a huge pipeline of applications
> for new entrants into the market). (Fernholz, 2019)

Another example of market disruption driving people into the black market is the case

of Canada. Opposite to the market situation in Oregon, Canada's legal market suffered a

low supply since its legal sales started in October 2018. The shortage of legal marijuana

stimulated the illegal sales by forcing users to purchase marijuana on the black market. In

a New York Times article published only several weeks after the legalization in Canada,

Mr. Tobin, who is a shopkeeper of a licensed retail establishment, complained that the low

supply of legal marijuana had pushed his customers to his illegal competitors (Bilefsky,

2018). He said:

> The government is just feeding the black market and our customers are going there. We are called high North. But legal weed is in such short supply that no one is getting high on it.

Until recently, the legal marijuana market in Canada is still having the problem of short supply. Michael Legary, a senior project manager with Manitoba's priorities and planning secretariat, points out that this issue is driving people back into the black market (Levasseur, 2019). He said:

> "Breaking the black market is a key aspect of legalization…[But] you have to have a legal supply available to do that. And if we do not have legal supply, people will go to the previous channels they were using."

Third, recording units from the sample shows that some illegal producers and organized crime groups lacks incentive to enter the legal market and only have the intention of growing marijuana for local and out-of-state black markets. Long-term illegal growers and drug cartels use the lax attitude and drug enforcement towards marijuana in legalized states to cover their illegal production. While some of their products are sold locally, the majority is trafficked to states where recreational marijuana remain illegal for much higher profit. This argument is mainly from people on the law enforcement side. About 19% of the recording units (n = 32) contains interviews addressing this issue. Terms such as "organized crime", "cartel", and "out-of-state" are frequently used to describe the causes of the black market.

In an article entitled "Marijuana's legalization fuels black market in other states," the author interviewed Paul Bennett, a lieutenant with the Riverside County Sheriff's Department in California (Hughes, 2017). Lieutenant Bennet described organized crime groups' involvement in California's illegal marijuana growing, said:

> The cartel's going to grow their marijuana in California because the risk is minimal…Legalizing marijuana at a state level has made the logistics of drug trafficking easier for cartels.

Colorado faces the same problem. El Paso County Sheriff Bill Elder points out that the high profit for out-of-state sales is the major driving force for illegal growers to sell their harvest to customers in other states (Estabrook, 2018). During his interview with the reporter, he said:

> [People] found that they could grow in Colorado safely and under the guise of Amendment 20 and load it into semis and drive it to the East Coast. In Colorado a pound of marijuana is worth roughly $1,500. On the East Coast it's worth anywhere from $4,000 to $6,000.

Some observers also share this view. When Canada was about to legalize recreational marijuana. A drug expert, Chantal Hebert, who was pessimist about the legalization, pointing out the danger of creating a more thriving black market. He said:

> "We only have to look to Colorado and Washington, which legalized marijuana only to find a flourishing black market controlled by organized crime." (The Toronto Star, 2017)

The content analysis of news articles identified three broad reasons that have caused people in legalized states to participate in the marijuana black market. With about 60% of the sample address the issue of overregulation, the analysis concludes that intensive regulation is one of the main reasons behind people's decisions to join the black market. To further assess if the strict and intensive regulations indeed influence the scope of black market, an interrupted-time series quasi-experiment is conducted to examine the impact of regulation intensity.

Interrupted Time Series Quasi-Experiment

Tables 2 and 3 present the interrupted time-series modeling results for Colorado and Washington, respectively. The trends of marijuana crime rates before and after the introduction of more intensive regulations are also visually presented in Figure 1 and Figure 2. As shown in Table 2, Colorado marijuana crime rates did not experience any significant immediate or long-term change before or after the two intervention points. Although Figure 1 and the coefficient values indicate crime rates have been decreasing since the first significant regulatory change and experienced an immediate increase as well as a long-term increase after the second regulatory change, none of these changes are statistically significant. This result indicate marijuana crime rates in Colorado are not affected by the implementation of more intensive regulations on legal businesses. The maximum lag to be considered in the autocorrelation structure in this ITSA modeling is four because autocorrelation is present at lag 1 and lag 3, but not at any higher lag orders (up to six lags tested). The autocorrelation test results are presented in Appendix A.

Table 2. ITSA Results on Monthly Marijuana Crime Rates in Colorado (2014-2017)

	β (SE)	t (95% Confidence Interval)
Trend before first regulation change	-0.04	-0.73 (-0.14 – 0.06)
Immediate difference after first regulation change	-0.33	-0.39 (-2.08 – 1.14)
Slope after first regulation change	-0.02	-0.26 (-0.19 – 0.15)
Immediate difference after second regulation change	-0.96	-1.25 (-2.51 – 0.59)
Slope after second regulation change	0.06	0.60 (-0.13 – 0.24)
Constant	9.63***	15.9 (8.41- 10.85)

Number of observations: 48
F (5, 42) = 10.16***

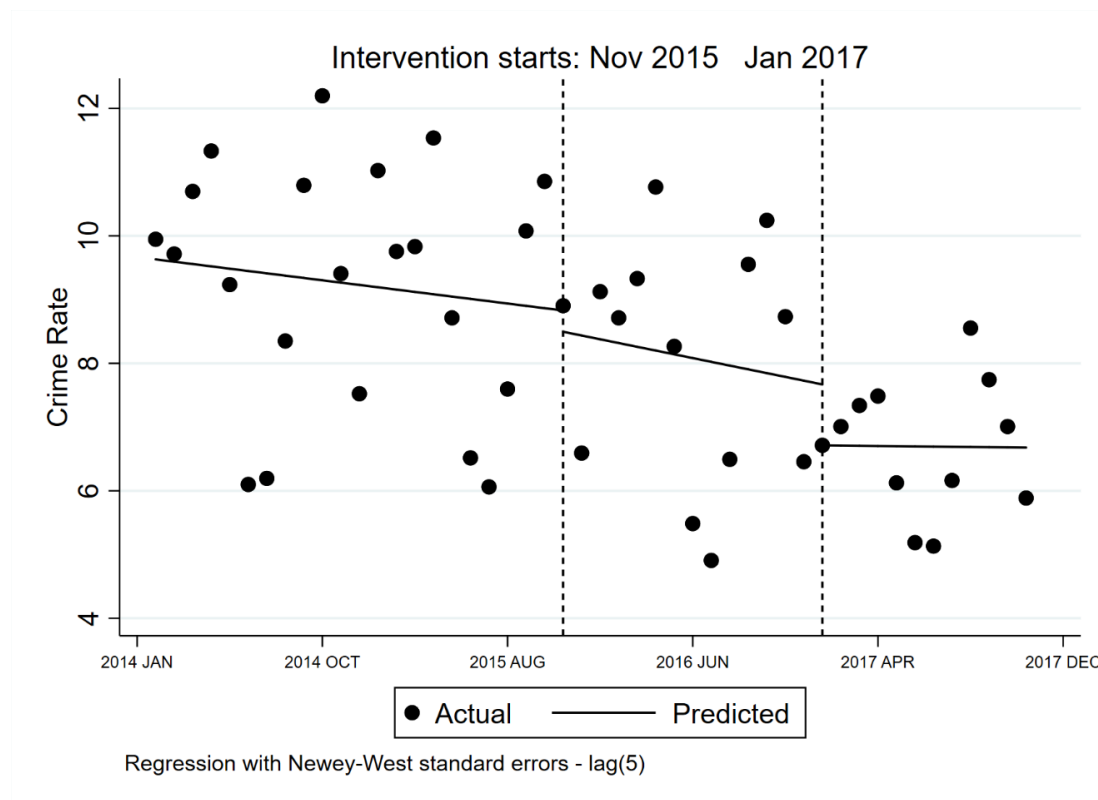* p<0.05   **p<0.1   ***p<0.01

Figure 2. Marijuana Crime Rates in Colorado (2014-2017)

Both immediate and long-term treatment effects of regulatory change in June 2016 on marijuana crime rates in Washington State are presented in Table 3. Marijuana crime rates had been slowly increasing in Washington State prior to the regulatory change (β=-0.03, p<.05). Immediately after a set of more intensive regulations were implemented, marijuana crime rates decreased by almost one percent (β=-0.68, p<.05). However, the post-intervention slope indicates marijuana crime rates have been slowly increasing since it became more difficult to operate legal marijuana businesses (β=0.05, p<.05). The maximum lag to be considered in the autocorrelation structure in this ITSA modeling is

four because autocorrelation is present at lag 1 and lag 3 but not at any higher lag orders (up to six lags tested). The autocorrelation test results are presented in Appendix A.

The ITSA modeling results for Washington's marijuana crime rates are also visually presented in Figure 2. Monthly marijuana crime rates were gradually increasing since the beginning of marijuana retail in Washington in July 2014. It dropped immediately at the point of the regulatory change in June 2016, and then steadily increased of since then. This finding is consistent with the prediction that more intensive marijuana regulations will result in more businessowners choosing to operate in the black market. The long-term trend after the intervention point is also a more accurate estimate than the immediate effect because it is expected that it may take some time for the public to react to the new regulations.

Table 3. ITSA Results on Monthly Marijuana Crime Rates in Washington (2014-2017)

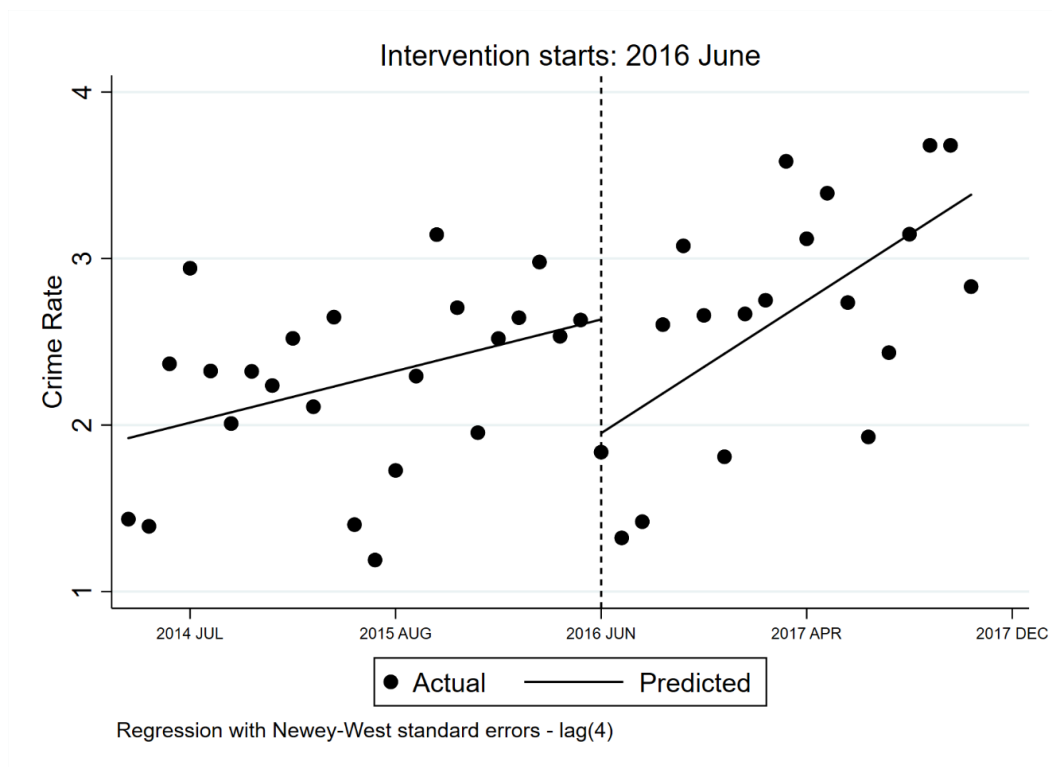|	β (SE)	t (95% Confidence Interval)
Trend before regulation change	0.03*	2.53 (0.01 – 0.06)
Immediate difference after regulation change	-0.68*	-2.50 (-1.24 - -0.13)
Slope after regulation change	0.05*	0.02 (0.005 – 0.09)
Constant	1.92	0.20 1.52 – 2.32)
Number of observations: 42		
F (3, 38) = 10.14***		

* $p<0.05$ **$p<0.1$ ***$p<0.01$

Figure 3. Marijuana crime rates in Washington (2014-2017)

Discussion and Policy Implications

While the United States is going through a trend of legalizing marijuana for recreational use and sale, many people, both consumers and producers, still choose to engage with cannabis illegally. In Colorado and Washington State, the first two states that legalized recreational marijuana, people are still being arrested for violating marijuana laws years after legalization. Unlicensed marijuana transactions are also commonly reported to account for a large portion of the overall marijuana market in legalized states (Logosco, 2014; Oregon-Idaho High Intensity Drug Trafficking Area, 2018; Staggs, 2018; Washington State Liquor and Cannabis Board, 2018). The prevalence of illegal marijuana activities raises the question of why people choose to stay in the black market when they can legally produce and trade recreational cannabis.

The content analysis of news articles reveals three main reasons to explain people's decisions to operate their marijuana businesses in the black market while legal options are available. The first and most frequently reported reason that drives people into the black market is strict regulations and the cost of compliance of those regulations. In their interviews with the media, many small growers and sellers complained that although they wish to open legal marijuana businesses, they could not afford all the costs and taxes that were associated with maintaining a legal operation. Some licensed marijuana establishment owners also sell cannabis in the black market to offset the cost of compliance. At the same time, the price of cannabis is much higher in the legal market due to taxation and fees, which creates a need for lower-priced cannabis in the illicit market. This finding is aligned with previous literatures that suggest high taxations, strict regulations, and unfriendly market are main causes for the black-market economy (Johnson, Kaufmann & Zoido-

Lobatón, 1998; Schneider & Enste, 2000; Schneider, 2005; Cetin, 2017; Getteman & Kennedy, 2014; Gabler & Katz, 2010). When the cost of compliance with state regulations is too high, staying or going illegal become a more practical option for small growers and sellers because they lack the capital to apply, open, and operate a legal marijuana business.

This finding from the qualitative data is tested by the interrupted-time series analysis on marijuana crime rates before and after Colorado and Washington introduced more intensive regulations. The interrupted time series analyses yield mixed results. On the one hand, no significant immediate or long-term changes were reported after Colorado adopted more intensive cannabis regulations in November 2015 and January 2017. On the other hand, marijuana crime rates in Washington State significantly dropped around the time when new regulations were implemented but continued to increase in the long run. These findings suggest that the magnitude of illicit marijuana activities may be affected by regulation intensity in some states.

A theory generated through the qualitative data is that the current regulatory system has turned the legal marijuana production and sale into capital-intensive businesses as it requires owners to invest a considerable amount of resources and finance to comply with the complex regulations. This has become the main factor that drives people, particularly small-scale growers and sellers, to stay in or move back into the black market. In this sense, regulating the cannabis market with more standards and requirements would lead to an adverse effect of both potential legal business owners and consumers fleeing to the illicit market to avoid the strict regulations. This theory is partially supported by the quantitative analyses of Colorado and Washington's marijuana crime data after legalization. Although the findings are not conclusive, the results of Washington data show that regulation

intensity may be one of the main factors that influences or explains the persistence of illegal cannabis transactions after the legalization. The fact that Washington's marijuana black market kept growing after the implementation of more complex and sophisticated regulations at least indicates a correlation between regulation intensity and the increase of the black market in the case of Washington. At a minimum, this finding, coupled with the results of qualitative analysis, raises the question of the possible adverse effect of intensive regulations to researchers and policy makers.

One result that the content analysis failed to predict is intensive regulation's ability to temporarily suppress illicit marijuana activities. The change of marijuana crime rates around the time when a major regulatory increase happened was not significant in Colorado, but Washington State experienced a reduction of marijuana crime rates immediately after the intervention. The difference between the immediate and gradual changes highlights the importance of differentiating regulation's long-term and short-term effects. More intensive marijuana control policies may be able to reduce black market transactions. Such success, however, could be short-lived. The positive effect of more intensive regulations will gradually wear off as the adverse long-term effect begin to show.

Besides regulations, content analysis findings also reveal two other explanations for the persistence of marijuana black market. People's willingness to participate in the black-market activates is sensitive to the changes of market situation, especially when the market saw a price decline or a disruption. For instance, when the price of marijuana drops drastically, many legal establishments cannot make enough profit to keep their businesses going. Consequently, some people would turn to the black market, very often in the form of out-of-state sales, for higher return. Another explanation is that some illegal growers

and organized crime groups, most of whom have been involved with illicit marijuana trade for a long time, stayed in the black market because they never had the intention to turn their businesses into licensed operations. While some small producers still sell to old customers on the local market, in most cases, they use the legalization as camouflage to hide the production and then traffic their product to out-of-state black markets.

The causal explanation powers of the two additional factors are not tested in the current thesis. However, together with the regulation factor, they provide important policy implications for cannabis control authorities. Most importantly, they suggest that the focus of the legalization should be creating an equitable and accessible market that allows the coexistence of both large and small businesses. The cost of compliance to regulations should be reduced to remove the barriers of establishing a legal marijuana business. The results of both the content analysis and interrupted series modeling indicate that the current regulations impose monetary and procedural costs for opening and operating legitimate marijuana establishments, which drives small business owners to find alternative channels to sell their products. It is dangerous to turn away small producers and retailers, many of whom have been growing and selling marijuana illegally for a long time and still constitute a large portion of the cannabis market. When they have difficulties to operate their business legally, they are likely to remain in the black market.

Another policy implication is that, instead of keeping marijuana business owners on a tight leash, cannabis control agencies should shift its focus to introducing broader regulations that guide the entire industry to establish a healthy and stable market. As suggested by Jensen and Roussell (2016), safety standards will naturally emerge in a healthy consumers market and marijuana business owners are more likely to gain benefit

and consequently continue comply in a loosely controlled legal market. This approach also has the potential of building a prosperous market where state can maximize tax revenue from legalized sales, save enforcement costs, and shift more responsibilities to the marijuana consumers and business owners.

Lastly, future policies should also pay more attention to cracking down persistent illegal growers and sellers and organized crime groups who are unwilling to participate the legal market. As the qualitative data shows, some long-term illegal cannabis businessowners who have been growing and selling marijuana to the local black markets long before legalization. Having a well-established illegal business and loyal customers, they lack a motivation to turning their businesses legal. It is important the law enforcement agencies target at this group. Meanwhile, policies should also be able to attract these businesses to join the legal market and minimize the barriers that prevent them to enter. For example, marijuana control agencies could recognize their expertise in marijuana production and allow people with prior records of marijuana offense to work or opening businesses in the legal market. As for organized crime groups who often have international affiliations, inter-agencies collaborations on state, federal, and even international levels are an effective way to crake down their illegal marijuana operations.

Limitations

As with all research, this study's findings should not be taken without considering the context of its limitations. The first limitation is that the qualitative analysis relied on indirect data retrieved from news articles rather than interviews conducted by the author. I did not have control over who were interviewed by the reporters and how the interviews were conducted. It is possible that biases possessed by the reporters or the media influenced what quotes were included in the articles. Being involved with illegal activities, it is also likely that some interviewees were attempting to justify their criminal behavior by exaggerating the impact of legalization on their businesses. Therefore, conducting interviews or focus groups with people participating or closely observing the marijuana illicit market using carefully designed interview questions may produce different results. However, this approach is not practical for this thesis as it demands considerable amount of time and resources and raises ethical concern of asking interviewees to disclose their illegal activities. Under these circumstances, analyzing interview data from news reports is the best alternative for conducting interviews directly with people involved with the black market.

Second, although interrupted time series modeling has long been recognized as a robust quasi-experimental design, its internal validity is subject to the threat of time-varying confounding variables. This thesis compares the dynamics of marijuana arrests before and after introducing more intensive regulations, but other shifts occurred at or around the intervention points may affect the internal validity of the results. For example, law enforcement agencies may adopt new policies or set new priorities around intervention points and the change of crime rates are subject to seasonality effects. Comparing the

treatment outcomes with a comparison group can reduce this concern. However, a multigroup modeling design is not feasible because there are no appropriate comparison groups. Even though marijuana crimes are reported across the country, the nature of this type of offense are not comparable between legalized states where only individuals who engage in unlicensed transactions will be arrested and other states where any recreational cannabis related activities are illegal.

Another limitation is measurement validity of "the scope of marijuana black market." In this thesis, it is measured as the number of marijuana offense reported to NIBRS per 100,000 population. This measurement has two weaknesses. First, only illegally marijuana activities that are officially reported were included in the analysis, which could be only a small portion of the black market. The interrupted time series modeling results suggest marijuana crime arrest rates continue to increase in Washington State and remained stable in Colorado after introducing more regulations. However, these findings may not be generalizable to the black markets in other legalized states because the analysis in this research does not examine illegal behaviors that have been undetected or neglected by law enforcement. Moreover, it is also reasonable to question whether the ratio between arrested marijuana crimes and all illegal behaviors remained constant or not during the period under study. The arrest ratio is usually sensitive to changes of law enforcement priorities and policies. Second, only arrests that were reported by state agencies to the NIBRS database was included in the analysis. Errors in how arrests were recorded or reported to NIBRS would consequently affect the validity of the findings. In addition, the monthly marijuana crime rates are calculated in two different ways due to the constraint of data availability.

The validity of this thesis may be affected by the inconsistency between how crime data is extracted between 2017 and other years.

Future Research

As an exploratory study, this thesis suggests possible directions of future research on the persistence of marijuana black market. The research framework set up by this thesis could be continued for the studies of regulation intensity in relation to black-market persistence on a larger scale. As more states began to legalize recreational marijuana, further research can utilize data from more states that have experienced significant policy changes and analyze their trends of marijuana illicit activities over a longer period of time. Scholars should also attempt to include marijuana related crime statistic from various official and unofficial sources into the analysis to account for illicit marijuana transactions that are either undetected by law enforcement or do not resulted in arrests. In this way, the scope of the marijuana black market can be constructed at the largest extend. Furthermore, as mentioned above, a limitation of this thesis is that the qualitative inquiries were based on secondary sources of news articles. It is worthwhile to talk with people working in the illegal marijuana industry directly. One-on-one interviews with individuals who directly participate in or closely observe the illegal industry can produce more reliable data that explains people's decisions to stay in the marijuana black market.

The different results from analyzing Colorado and Washington crime data indicate that there are other factors may cause the persistence of the black market. These factors are also worth further exploration. For instance, as identified in this thesis, criminologists and economists should collaborate to study if the magnitude of marijuana black market is impacted by the overall market situation such as changes of retail prices and cannabis production/demand ratio. Another research focus is the influence of lucrative out-of-state marijuana trafficking and sales on the illegal production of cannabis in legalized states. In

other words, it is worth investigating how illegal growing and out-of-state trafficking are camouflaged under legalization and how regulations law enforcement operations can effectively prevent or deter such illegal activities.

More importantly, the findings of this thesis show small-scale marijuana businesses are more vulnerable to strict regulations than well-financed corporations. Small business owners are more likely to choose to stay in the black market or to divert their legally grown cannabis into the black market to offset the cost of compliance. Therefore, it is necessary to separate small and large marijuana businesses in future inquiries regarding marijuana legalization. For examples, when studying the impact of cannabis control policies, scholars and policy makers need to consider how small and large marijuana establishments will respond to the new policies differently. Research should address the question of how to create a legal market that is friendly to both types of businesses. After all, marijuana black market will unlikely to eliminated if small marijuana producers and sellers cannot successfully find their place in the legal market.

Conclusion

Even though one of the main arguments for the legalization of recreational marijuana is that establishing a legal market would eliminate the black market, crime statistics show that illicit marijuana market persists after the legalization. This thesis made the first attempt to explore why marijuana producers and sellers choose to stay in the black market when licensed growing and retail are permitted. By analyzing both quantitative and qualitative data, it tested the hypothesis that more intensive regulations will lead to more illegal marijuana activities.

The content analysis of news articles reveals three main reasons for the persistence of the marijuana black market after legalization. First, strict regulations and the cost of compliance for operating a legitimate marijuana business would drive people, particularly small growers and sellers, to the black market. Secondly, unstable market situation could motive producers to try to dispose their cannabis through other channels, usually illegally sell them to the local black markets or transport to out-of-state black market. Lastly, traditional drug dealers and traffickers have no intention to participate the legal system because the main goal of their operations is to sell cannabis to states where recreational marijuana is still illegal.

The effect of regulation intensity on marijuana black market is partially supported by examining the trend of marijuana crime rates in Washington State and Colorado before and after the implementation of more intensive regulations. The results of interrupted time series modeling show that after Washington State introduced an increasing number of intensive regulations, marijuana crime rates experienced a short-term decline while the crime trend kept growing over time. The influence of regulation intensity on marijuana

crime rates is insignificant in Colorado. In general, the analyses on two states' marijuana crime rates indicate implementing more intensive regulations may be a possible explanation to the persistence of cannabis black market. However, the magnitude of its influence and the market and policy environments that allow this type of effects to exist are yet to be answered by future research.

Overall, the findings of this thesis suggest that overregulation can be harmful to the legal recreational marijuana market. It is possible that the desire to control the legal marijuana market via regulation is misguided. Unnecessarily strict regulations may create an environment in which operating in the illegal market may be a reasonable option for some marijuana businesses. Every piece of regulation adds costs to maintain a legal marijuana establishment, which at a certain point, may drive the businessowner to the illicit market. Meanwhile, the demand for black market marijuana products is still vibrant after legalization because they are less expensive and easy to access. Facing these situations, implementing excessive restrictions on legal marijuana establishments could ultimate end up with a cycle of flourishing black market, greater need for market control, to more intensive regulations. That said, it is worth noting that under-regulation is equally dangerous. Oregon's experience shows that a loosely regulated marijuana industry will result in disturbance in the legal market. This result is not surprising given the fact that weak regulations cannot effectively establish an ordered legal market or prevent cannabis being diverted into the illicit market. For researchers and policy makers, it is important to find a balanced point that regulations do not force marijuana businesses to seek illegal options while the level of intensity is sufficient enough to keep a well-managed legal market.

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Appendix A – Interrupted Time Series Modeling ACTEST Results

Table 4. Colorado ITSA Modeling ACTEST Results

Lag	Chi^2	P value
1	9.14	0.003
2	3.42	0.06
3	10.23	0.001
4	3.89	0.05
5	0.26	0.61
6	2.65	0.10

Table 5. Washington State ITSA Modeling ACTEST Results

Lag	Chi^2	P value
1	5.42	0.02
2	1.91	0.17
3	6.30	0.01
4	0.68	0.41
5	0.25	0.62
6	0.33	0.56