

The 'High' Economic Benefits of Legalizing Marijuana in Canada

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2. Introduction

Marijuana or *Cannabis sativa*, is a hemp plant that grows freely across many parts of the world. The marijuana plant is one of the oldest natural psychoactive substances known to humanity. It is botanically classified as a member of the family Cannabaceae and the genus *Cannabis*. There are at least three species of marijuana: *sativa*, *indica* and *ruderalis*. The most widespread of the three (*Cannabis sativa*), is a tall, gangly and loosely branched plant that can grow upwards of twenty feet high, which resemble a large weed (hence the nickname 'weed'). The marijuana plant contains more than 460 known compounds, of which about 60 have the 21 carbon structure of cannabinoids. The specific cannabinoid that is mainly responsible for producing the psychoactive effects is delta 9 tetrahydrocannabinol (THC). In recent research, the discovery of nerve receptors in the human brain indicates that the body actually produces its own version of THC. The consumption of marijuana causes a 'high', which users tend to describe as a euphoric feeling coupled with relaxation, increased appetite and the tendency to laugh. There are two major ways to administer the drug, either orally or smoked in a cigarette form. Although the intoxicating effects of marijuana have been known around the world for thousands of years, it was only at the turn of the 20th century that North America discovered these effects. Classified in the pharmacopoeia literature as a hallucinogenic, psychodysleptic or psychotomimetic, cannabis is a disrupter or modulator; it alters perceptions and emotions. Classified in the international conventions and national legislation as a narcotic, cannabis belongs to the class of psychotropic's which comprises five major groups: depressants (alcohol, Valium), stimulants, minor (coffee, nicotine) and

major (cocaine, amphetamines), disrupters (cannabis, LSD), antipsychotics and medication for mood disorders (lithium).

The past several decades have witnessed a controversial debate about the possible merits that might be brought about by decriminalizing or legalizing marijuana. Possession of marijuana in Canada is still a criminal offence and has generated significant economic costs. The enforcement of prohibition is consuming a large portion of police resources, is a primary source of revenue for organized crime and burdens thousands of individuals with stigmatic criminal records. The enforcement of marijuana laws has also entailed the sacrifice of many of our fundamental rights and freedoms. The law has not significantly stopped the production or consumption of marijuana. There is nothing in the tenants of free market economics that would argue for the legalization of marijuana, in fact the presumption is that decriminalization or legalization of marijuana should only enhance overall welfare. Canada is a social system based on the recognition of individual rights and based on an objective theory of values. Unfortunately Canada's marijuana laws are not in line with the basic tenets of the Canadian value system; marijuana laws were not created from a rational standard of value and validated by a process of reason. A capitalistic nation (Canada) is based on an objective theory of value; that 'good' is based on an evaluation of the facts of reality by our consciousness according to a rational standard of value. This paper argues that Canada's marijuana laws are not rational, and will evaluate marijuana legalization from a rational standard of value and provide economic evidence for the legalization of marijuana.

Entangled in the debate surrounding the prohibition of marijuana is a debate

regarding the costs and benefits that would be brought about by decriminalizing or legalizing marijuana. In a survey of one hundred and seventeen economists, fifty-eight percent were in favor of changing public policy in the direction of decriminalization of marijuana. When given a choice of policy options seventy-one percent favored legalization or decriminalization and the rest favored measures of deterrence at least as strong as the current status quo. These arguments have lead to a number of studies that have attempted to assess the impact of marijuana prohibition. For example, a recent study by Scott Bates considered the economic effects of marijuana prohibition and the consequences of decimalizing marijuana in Alaska. The study estimated that Alaska was spending somewhere between twenty five to thirty million dollars a year enforcing marijuana prohibition. Jeffery A. Miron from MIT, made a similar claim to that of Bates, by assessing the implication of drug laws in the state of Massachusetts. Using similar principals and assumptions as the other study, Miron estimated that the state would reduce its criminal justice expenditures by \$120.6 million per year, of which the state would realize court savings of \$68.5 million, police savings of \$40.3 million and corrections savings of \$13.6 million. However, there has been no substantial research into the economic or budgetary costs and benefits of legalizing or decriminalizing Marijuana in Canada. The first part of this report is a literature review on some of the common assumptions of why marijuana is evil and should be prohibited; it will then assess to claims of potential benefits of marijuana and will conduct an unbiased economic benefit cost analysis of a movement from current drug laws to marijuana legalization and decriminalization.

Stephen Harper has scrapped previous legislation projects to decriminalize marijuana, and is calling for harsher prison sentences for those convicted of drug related crimes. There are a number of underlying common assumptions in the conservative platform to replicate the United States 'war on drugs'. The common assumptions of why marijuana should be prohibited include the Gateway Theory, marijuana is addictive, marijuana causes individuals to commit crime, marijuana causes people to become violent and that has a number of negative health impacts.

If a Gateway effect (that marijuana use causes the use of harder drugs) exists, then the evidence of such effect will support the prohibition laws. There does exist a statistical relationship which supports the idea of a sequence of drug use, but it is not a gateway effect, this paper will debunk the gateway theory by considering the problem of causality in previous research, the unobservable characteristics of those who move from soft to harder drugs, that the sequence is out of order and that the reverse relationship does not hold. Another common assumption raised by those who support marijuana prohibition is that marijuana is addictive. If marijuana were addictive then there would be considerable downstream externalities. This claim assessed the research into addiction and concludes that marijuana is addictive. Hit then debunks the arguments that marijuana should be prohibited because it is addictive by considering the relative risk of addiction, increased prevalence rates of addiction is a positive sign and that unobserved characteristics are the root of an addiction problem, not marijuana. The next assumption that is evaluated is that marijuana causes individuals to commit crime this section reviews the literature on this relationship and finds that there is no evidence base for this argument, this section discredits the idea that people commit crime to fund marijuana habits, marijuana causes

behavioral change instigating crime, that there exists no causal link, that the unobserved factors play a more important role in explaining the crime relationship and that the tests for marijuana among criminals are biased. The next assumption that was evaluated was that marijuana causes people to become violent; this section reviews the research on marijuana and violence and finds mixed results. After careful analysis of the research this paper argues that the relationship does not exist, as the prohibitionists believe, this section considers the relation between obtaining marijuana and violence, the confounding factors which explain the relationship, examines violence and withdrawal and considers the reduced mental functioning of users and violence.

Finally the last assumption of prohibition is that marijuana has a number of harmful health effects. This claim is evaluated by critically analyzing the current literature on acute and long-term physiological and psychological effects of smoking marijuana. After consideration of the recent literature it is concluded that there are no serious negative harmful effects of marijuana consumption.

Although each of the underlying common assumptions of why marijuana is prohibited find no clear rational evidence to support a prohibition of marijuana, there are still some costs associated with marijuana consumption, if these costs outweigh the benefits of legalization, then Canada should continue to prohibit marijuana. The final section of this report is an assessment of the two possible benefits of legalization of marijuana which are a reduction in organized crime and possible therapeutic benefits of marijuana. After a careful consideration of the research on prohibition and organized crime, this paper concludes that with the legalization of marijuana there would be a substantial decrease in the prevalence of organized crime. Furthermore after a literature

review on the medical benefits of marijuana this research concludes that marijuana has a number of medical benefits that could be exploited further if marijuana were legalized. The paper will then consider the benefits from marijuana decriminalization or legalization that include the savings to the police system, the court system and the prison system, the reduction in organized crime and the gain in consumer surplus. The analysis will also consider the economic costs of marijuana that include: the direct cost of health care, research and development expenditures, political backlash costs, trafficking costs, indirect damage costs and the economic cost of loss income. After a full assessment of all costs and benefits, this study will make are recommendations that marijuana should be legalized based on standard benefit cost analysis techniques and will consider several limitations of this analysis.

3. Physical and Psychological Effects

A common argument proposed by those who support marijuana prohibition is that marijuana has a variety of negative health impacts on those who consume the drug. Those who support marijuana prohibition argue that keeping drugs illegal reduces demand and saves an economy's resources, as a nation needs to spend less on drug abuse and drug use problems. Often marijuana is cited to cause brain damage, impotence and is a leading cause of lung disease. The purpose of this section is to review the recent research and literature on the acute and chronic physical and physiological effects of consuming marijuana. In order to fully account for possible economic costs and orbenefits from a

change in policy, the possible existence of health effects needs to be established. The effects of a drug can be classified into two broad categories: acute effects (resulting from a single dose) or chronic (resulting from long term use). A distinction can also be made between physical and psychological effects. This section will examine the acute and chronic physical effects, which include those on heart rate, motor skills, respiratory system and reproductive systems. It will also consider the acute and chronic psychological effects of marijuana use, which include cognitive skills, depression, and increased risk of schizophrenia.

What do we mean when we say cannabis products? From most potent to least potent, Hashish and charas, Ganga and sinsemilla, bhang and marijuana (10 – 20 percent THC), (5 – 8 percent THC) and (2 – 5 percent THC). What makes marijuana so bad? what is all the fuss over a plant about? Marijuana is difficult to classify, it is like a sedative, but not like barbiturates because high doses may alter perception but do not produce strong anesthesia, coma or death¹.

THC is absorbed into the blood at the rate of 0.4mg to 10mg from smoking one marijuana cigarette. THC, when inhaled is called a bronchial dilator, meaning it initially expands and then contracts capillaries impairing lung functioning (because most marijuana is smoked - oral or intravenous THC does not affect the lungs). THC is taken out of the blood and moves into fatty tissues in the body. THC is metabolized rapidly, but the metabolites are slowly eliminated. Approximately 80–90% of the dose is excreted in 5 days, 65–80% in feces and 20–35% in urine. Continuous consumption will accumulate

¹ Grinspoon and Bakalar, 1993

in the system and can take weeks or months to leave the human system.² Once THC has entered into the system, it binds to cannabinoid receptors on nerve terminals in the brain. Upon connection in the brain, it activates or inhibits a number of signal transduction pathways. The cumulative effect is a euphoric feeling or ‘high’, which is typically associated with cannabis use.

3.1 Acute physical effects

The first acute physical effect of smoking marijuana is conjunctival hyperemia, which is the reddening of the eyes via dilation of the small blood vessels in the whites of the eye. Consuming marijuana also increases the blood pressure in the heart by about 14 beats per minute. To the degree that marijuana increases conjunctival hyperemia and the heart rate is neither dangerous nor uncomfortable for most people. There may be some concern that smoking marijuana by older people with cardiovascular disease poses great risks because of the resulting increased cardiac work.³ Marijuana also reduces cognitive–motor skills and brain mechanisms that modulate coordinated movement,⁴ which increases with the potency of the marijuana.⁵ It is not possible to overdose with marijuana; there has not been one documented case of physical harm causing death. Cannabinoids also affect multiple reproductive functions, from hormone secretion to birth of offspring. The acute use of marijuana can lead to reduction in hormone levels in both males and females (but recovery occurs from this)⁶. There is no consistent

² Grinspoon and Bakalar, 1993

³ Khalsa, 2007

⁴ Weinstein, 2008

⁵ Ramaekers, 2006

⁶ Khalsa, 2007

impairment to the human immune system after consumption, and no evidence that users are more susceptible to infection⁷. The fact that the THC derivative Marinol has been approved for use by the US Food and Drug Administration for the treatment of weight loss and nausea in cancer and AIDS patients shows that THC does not impair the immune system and does not exacerbate bacterial or viral infections.

At low doses marijuana use can cause drowsiness or sleepiness, and in high doses can sometimes impair sleep patterns. Marijuana use can suppress rapid eye movement (REM is a normal stage of deep sleep characterized by the rapid movement of the eyes) during sleep and can increase slow wave sleep patterns. The use of marijuana causes thirst and a dry mouth, and there is an increase in the caloric intake, as your metabolism speeds up with the increase in the heart rate causing increases in appetite⁸. Of the acute physical effects of marijuana, there are no serious negative effects that would be of serious concern.

3.2 Chronic physical effects

The long-term effects of marijuana use have been studied across four main systems: the effects on the immune system, cardiovascular system, reproductive systems and pulmonary and respiratory systems. There appear to be no negative chronic effects on either the immune or cardiovascular systems, research shows that generally the effect on these systems is restricted to acute physiological effects.

⁷ Ibid

⁸ Haney, 2005

However, there is some evidence that suggests that smoking marijuana has negative effects on the pulmonary and respiratory systems. Marijuana cigarettes contain more tar than tobacco cigarettes, and cannabis tar contains greater amounts of cancerous agents (i.e. carcinogens) than does tobacco tar⁹. This is of great concern as marijuana is usually smoked in a cigarette form or from a pipe, and both do not have proper filters and are therefore more dangerous than simple tobacco smoke. Furthermore, marijuana users tend to hold in the smoke longer than tobacco in order to maximize the effectiveness of the drug. It is clear that smoking marijuana, like smoking anything, will affect the respiratory system. Chronic heavy smoking of marijuana is associated with increased symptoms of bronchitis, coughing, production of sputum and wheezing. Further research has shown that chronic marijuana smoking is associated with poorer lung function¹⁰. Physiologic data has been analyzed to show that long-term marijuana smoking is associated with increased respiratory symptoms suggestive of obstructive lung disease¹¹. It is unclear if there is a direct link between marijuana smoking and lung cancer or other forms of cancer¹². A study conducted by Hasibe and colleagues (2006) examined long time marijuana users and found that, when adjusted for several confounding factors, including cigarette smoking, there were no positive direct associations for lung or upper aero-digestive tract cancers. Still, most of the research shows some link between marijuana smoke and lung cancer. For example, a case-control study by Aldington and colleagues (2008) examined lung cancer in adults 55 years of age in eight district health boards in New Zealand. They found that the risk of lung cancer increased 8% for each

⁹ Jones, 1980

¹⁰ Bloom et al (1987) and Tashkin et al (1990)

¹¹ Tetrault, 2007

¹² Hasibe et al, 2006

joint year of cannabis smoking. After adjustment for confounding variables including cigarette smoking, this risk was still 7%. The highest frequency users of cannabis were associated with the highest increased risk of lung cancer (relative risk 5.7%), after adjustment for confounding variables including cigarette smoking¹³. In a recent literature review by Mehra (2006), the impact of marijuana smoking on the development of premalignant lung changes and lung cancer was assessed. Studies that examined lung cancer risk factors or premalignant changes in lung functioning found an association between marijuana smoking with increased tar exposure, alveolar macrophage tumoricidal dysfunction, increased oxidative stress, and bronchial mucosal histopathologic abnormalities compared with tobacco smokers or non-smoking controls. Given that most users of marijuana prefer to administer the drug through inhalation of marijuana smoke, and studies predominantly supporting biological plausibility of an association of marijuana smoking with lung cancer on the basis of molecular, cellular, and histopathologic findings¹⁴, there is a considerable increased risk of lung damage among marijuana users, due to the way in which marijuana is typically consumed.

There have been two major studies done on the effects of marijuana on reproductive systems and development. The first study examined women who smoked marijuana regularly during pregnancy to determine the developmental consequences of marijuana on offspring. Both studies followed women before and after pregnancy and found that there was reported fetal growth retardation, reduced gestation period, mild withdrawal symptoms and some disruption of nervous system state regulation. After the children had reached between 4 and 6 years of age, there seemed to be some impairment

¹³ Aldington et al 2008

¹⁴ Mehra, 2006

of verbal ability, memory and sustained attention suggesting an association of prenatal marijuana exposure and impaired functioning on some levels¹⁵.

From the scientific research, it is clear that there is at least a link between smoking marijuana and lung cancer, although the debate in regards to a direct causal relationship remains unclear. The use of marijuana appears to, at a very minimum, increase the probability or acts as a catalyst among other factors to promote the growth of lung cancers. It is important to note that these studies are looking at the marijuana smoke specifically, and there are many substances that, if smoked, would cause various forms of cancer. Furthermore, chronic use of marijuana during pregnancy seems to be associated with a number of detrimental development consequences of fetus, newborns and children whose mothers were high frequency marijuana users.

3.3 Acute Psychological Effects

The consumption of marijuana is very different than the consumption of most goods, as it possesses the ‘externality of being high’ (i.e. there are external psychological effects), which could be described akin to consuming alcohol. The psychoactive effects of cannabis, more than any other substance, vary from one subject to another and, for the same subject, from one experience to another. Additionally, with no reliable method to measure THC content in plasma, it is difficult to link the duration and strength of the effects of marijuana. To untangle whether these effects are co-occurrence, coincidental,

¹⁵ Khalsa and Grfoerer (1991) and Fried (1995)

or from extremely high doses of marijuana and or some interaction between these factors, can only be answered with further laboratory research.

Upon consumption of marijuana, the first ‘phase’ of acute effects include: a change in general mood accompanied by gaiety, increased intellectual functions (i.e. increased self-confidence, magical thinking, distorted perception of time, space and self-image, alteration of sensory perceptions; marked by increased sensory perceptions [colours and sounds sometimes seem more intense] and stronger tactile impressions). More than any other known drug, the effects are modulated by surroundings (self recorded mood ratings—correlated with mood of others)¹⁶. The second phase is a ‘coming down’ phase that is characterized by a feeling of sluggishness and drowsiness and appears to gradually fade over time.¹⁷

Cannabis also effects several aspects of cognitive function, with what appears to be the greatest effects on short-term memory. Marijuana’s effect on short-term memory is one of the most consistently reported findings on the cognitive effects of marijuana are the alterations in memory functioning. In 1845 the French psychiatrist De Tours Moreau stated that one of the most prominent effects of hashish was “gradual weakening of the power to direct thoughts at will.”¹⁸ Many of his followers have noted that people display a fragmentation of thought and confusion on attempting to recall specific occurrences while under the influence of marijuana. Orally administrated THC has been shown to induce what is called “temporal disintegration”,¹⁹ which is having difficulty in retaining,

¹⁶ Hellerman, 2010

¹⁷ Nolan, 2002

¹⁸ Nahas, 1999

¹⁹ *ibid*

coordinating and serially indexing memories. The results of the largest survey on the acute effects of marijuana on memory found that

“acute administration of Δ -9-THC transiently impairs immediate and delayed free recall of information presented after, but not before, drug administration in a dose- and delay-dependent manner. In particular, cannabinoids increase intrusion errors. These effects are more robust with the inhaled and intravenous route and correspond to peak drug levels.”²⁰.

It appears as though marijuana, more specifically, cannabinoids impairs various stages of memory including; encoding, consolidation and retrieval²¹.

Apart from the effects on memory, acute intoxication with marijuana also causes changes in brain functioning and neuropsychological performance. Changes in brain functioning and neuropsychological performance seem to be mild and can appear after some abstinence²². As the consumption of marijuana is increased, performance typically decreases on tests measuring memory, executive functioning, psychomotor speed and manual dexterity²³. In a study on the effects of abstinence over a period, the authors found that marijuana use slightly impaired performance on a circular light task in all subjects. Performance was also impaired on serial addition/subtraction and digit recall tasks. After one day of abstinence, performance remained impaired on the arithmetic and recall tasks, suggesting that marijuana can adversely affect complex human performance up to 24 hours after smoking²⁴. Neural imaging of individuals who have consumed marijuana often reveals subtle differences in the brain functioning of abstinent cannabis

²⁰ Ranganathan, 2006

²¹ Ibid

²² Bolla, 2002 and Gonzalez, 2007

²³ Gonzalez, 2007

²⁴ Ibid

users compared with controls²⁵. The persistence and clinical significance of many of these acute effects are most well observed among heavy users²⁶. These impairments do not show up in surveys of recreational users of marijuana, and these effects are not long lasting after the user has abstained from marijuana use for several months.

3.4 Chronic Psychological

Whether chronic marijuana use can cause serious long-term psychotic or affective symptoms that persist beyond the acute intoxication is unclear. In a recent systemic review of the evidence on marijuana use and occurrence of psychotic and mental health outcomes, found that there was an increased risk of any psychotic outcome in individuals who had ever used cannabis, with the risk increasing in those who used marijuana more frequently. Findings regarding depression, suicidal thoughts, and anxiety outcomes were less consistent.²⁷ The evidence is consistent with the idea that marijuana use can increase the risk of certain psychotic outcomes. However, the authors point out that the direct link cannot be resolved by further longitudinal studies²⁸, and suggest that there needs to be causal and theoretical links in order to argue with confidence that those who use marijuana increase their risk of developing psychosis later in life.

There is also evidence that marijuana use can lead to schizophrenia. A recent literature review found that there is an increased risk associated with marijuana use and schizophrenia.²⁹ One of the major studies found across a relationship between heavy

²⁵ Gonzalez, 2007

²⁶ Ibid

²⁷ Theresa, et al, 2007

²⁸ Ibid

²⁹ Arseneault et al, 2004

cannabis use 18 years of age and a subsequent diagnosis of schizophrenia within the 15 year follow-up period. This effect persisted after the confounding effect of pre-existing psychiatric diagnosis was controlled for, with a relative risk of 2.3%. The other major study, which examined children at age 11 years, among those whose use of marijuana preceded the age of 15 years, there was a 3.1 higher odds ratio of developing adult schizophrenia. Although the direct casual link does not exist, initial data suggests that marijuana use is associated with later life development of schizophrenia for some individuals. Many researchers theorize that marijuana use does not directly bring about this in any individual. They believe that marijuana acts as a catalyst for those with pre-existing conditions (for example those with unstable psychological conditions) and those who schizophrenia is a genetic risk factor. The idea is that marijuana does not *cause* these psychological problems but is one of many factors that can lead to increased risk for those who are already at risk of developing certain conditions.

There is speculation that chronic marijuana use is associated with depression, however, both scientific and anecdotal evidence is mixed. There are three main theories as to why marijuana use may be associated with depression. The first is that depression causes marijuana use (i.e. as a coping mechanism), this has not been supported in the literature³⁰. The second theory is that there is a common factor, or an unobserved characteristic that increases the risk of depression. There is some evidence that depression does arise from certain genetic and other vulnerabilities.³¹ The third and most controversial theory is that marijuana use causes depression, but the results of studies on this theory are mixed.

³⁰ Harder ,Morral and Arkes, 2006

³¹ *ibid*

In a recent review of the literature on marijuana and depressive symptoms, Harder, Morral and Arkes found that “there is widespread evidence that marijuana use and depression co-occur more often than expected by chance alone.” They applied a statistical causal model to determine if there was some direct link between chronic marijuana use and depression. They found that after adjusting for differences in baseline risk factors (i.e. age, gender) of marijuana use and depression, past-year marijuana use does not significantly predict later development of depression. In an assessment of cannabis-dependant subjects, on self reported reasons for marijuana use. Participants with lifetime depression and problems controlling violent behaviour were compared to subjects without such problems. Ardent, 2007 found that subjects with lifetime depression used cannabis for the same reasons as other recreational users, however, they also found that while under the influence of marijuana they experience more depressive symptoms³². The association between marijuana use and depressive symptoms was most recently examined longitudinally in a sample of 622 African American youth. This study considered whether depressive symptoms predicted changes in marijuana use and vice versa and the results indicated that depressive symptoms did in fact predict later marijuana use, but only for males. Marijuana use did not predict later depressive symptoms for females or males. The authors concluded, “Previous research on the link between depression and marijuana use has been equivocal. One reason may be that researchers have not examined a reciprocal influence hypothesis and it is possible that over time, depressive symptoms and marijuana use does influence each other, making it difficult to establish a causal relationship between them. Therefore, the links between

³² Ardent, 2007

these two behaviors may be complex and may change over time. This may explain the varied findings across different studies. It is also possible that the differing results reported may be due to differences in the samples studied which may be especially relevant when studying mental distress and psychopathology³³. However, in one study when cannabis users were asked to rate the effects of their own cannabis use as positive, neutral, or negative, they gave overwhelmingly negative ratings of the effects that cannabis had had on their social life (70%), their physical health (81%), their mental health (60%), their cognition (91%), their memory (91%), and their career (79%)³⁴. It seems a reasonable hypothesis that the negative effects these long-term heavy cannabis users reported are due to being acutely intoxicated every day. People intoxicated with cannabis demonstrate impairments in a variety of cognitive, perceptual, and psychomotor tasks.

3.5 Conclusion

There are a number of serious methodical barriers to finding the direct links between marijuana use and chronic impairment. Experimental data are lacking because one cannot ethically recruit a group of individuals to consume large amounts of cannabis for a long period of time. The only available data comes from marijuana users in uncontrolled settings, which have many biases inherent in naturalistic studies³⁵. This makes the interpretations of many of the research on chronic marijuana use and long term cognitive effects extremely hard and is one of the many factors creating the uncertainty and ongoing debate on these issues.

³³ Repetto, 2008

³⁴ Gruber, 2003

³⁵ Repetto, Zimmerman and Caldwell, 2008

The arguments by those who support marijuana prohibition because of the serious negative impacts on health are not justified. The Canadian Center on substance abuse recently produced a report on the effects of marijuana on human cognition, which concluded that studies examining the effects of chronic cannabis use on cognition have generally failed to yield evidence of severe abnormalities³⁶. The acute effects of consuming marijuana are generally harmless and dissipate within 48 hours of use. There does exist a link between marijuana use and the increased risk of lung cancer, however part of the problem is that marijuana cigarettes are currently unregulated and people who smoke marijuana do so without a proper filter. If marijuana were legalized, filters could be used to drastically reduce the effects of carcinogens from marijuana. The impact of marijuana on fetal development is also of significance, but is not linked to the prohibition of marijuana. It is more likely a problem of misinformed pregnant women, and prohibition would have no effect on reducing the problem of a mother not caring for her body while pregnant. Furthermore, the existence of the increased risk of marijuana on psychosis, schizophrenia and depression is unclear, but at the very most suggest the influence of a number of interacting variables and relationships and that marijuana is certainly not the sole cause of any of these health problems.

4. Marijuana and Addiction

The purpose of this is to define what constitutes an addiction, review the literature on marijuana and if it does fall under the definitions of an addiction – consider

³⁶ Porath-Waller, 2009

neurobiological basis and if there exists withdrawal symptoms. I will then argue that there is no rational basis for the prohibition of marijuana based on the fact that it is addictive and that prevalence rates for addiction of marijuana have been increasing over the last 30 years.

4.1 Defining Addiction

Many definitions of addictions have been proposed, from the need for intoxication, to theories that place the center of addiction on decision-making and choice. One textbook definition of addiction is the “overwhelming involvement with using a drug, getting an adequate supply of it, and having a strong tendency to resume use of it after stopping for a period.” There is also criteria for dependence like *tolerance* (increase amounts of a drug needed to achieve intoxication, or a diminished drug effect with continued use of the same amount of a drug) and *withdrawal* (definable illness that occurs with a cessation or decrease in use of a drug - usually opposite to the drugs original effect)³⁷. Addiction is a complex idea, and has been studied extensively over the last 40 years.

Addiction has nothing to do with the legality of a substance. An addiction is a substance or behavior dependence with a loss of control; humans can have all sorts of addictions including sex, video games, gambling, drugs, alcohol and work. What is important to note, with respect to marijuana and all addictions, is that not all people who use a substance become addicts, and not all who continually use or have a high frequency

³⁷ Maisto, 2008

of use become addicted or would be labeled as “drug abusers”. There are three elements, fundamental for forming an addiction: stress, vulnerability and a substance or behavior.³⁸

4.2 Scientific Evidence of Marijuana Addiction

For years the conventional wisdom held that marijuana was not truly addictive. The advocates for marijuana reform have been using this argument since the 1970s when federal governments began to crackdown on marijuana users. The recent research has contradicted the statements made by marijuana reformers and the view that marijuana is not addictive should be altered by a number of recent discoveries.³⁹ For those individuals that develop cannabis dependence, the consequences of their addiction can be as serious as those of addictions to other illicit drugs. The medical, legal, and psychiatric impairment associated with cannabis dependence appears roughly comparable to that of cocaine dependence.⁴⁰

The neurological evidence on the addictive nature of marijuana has been studied in recent years. Research has found that the activation of the dopamine system has been implicated in marijuana use and is important in drug reinforcement. THC has been shown to increase dopamine release in the specific parts of the brain which deal with reinforcement and are associated with addiction and dependence. Cannabinoids have been shown to interact with a number of neurotransmitter systems, its interactions with this dopaminergic system and with the opioid system are believed to be important in

³⁸ Hellemans, 2010

³⁹ Compton, 2004

⁴⁰ Nordstrom, 2007

facilitating dependence and addiction.⁴¹ Neuropsychopharmacological studies have also helped clarify the controversy on the addiction liability of marijuana by showing that THC and cannabinoids fulfill most of the common features attributed to compounds with reinforcing properties for the addictive properties of drugs.⁴² There is clear scientific evidence that THC and cannabinoids have the same reinforcing effects as most addictive substances and behaviors, and therefore fit our definition of an addictive substance.

In addition to the reinforcing effects of marijuana, its ability to produce withdrawal symptoms when removed from an animal organism is another important aspect of dependence. Not only is THC reinforcing but also there are well-established withdrawal symptoms and states in individuals when the drug is removed. Initially, there were many scientific research methodological weaknesses in studies on marijuana withdrawal, which included variable levels of drug-does administration, lack of controlled studies and the absence of definition of the withdrawal syndrome. In the past it was suggested that studies do not actually provide a strong enough research base for drawing a clear conclusion that there exists cannabis withdrawal syndrome in human users.⁴³ Although the definition of a specific cannabis withdrawal syndrome is still unclear, recent reviews and research have found the presence of a number of marijuana withdrawal symptoms in human users⁴⁴. The lack of a clear definition does not mean that there exists no withdrawal symptoms or syndrome associated with marijuana consumption. In 2006 Budney argued that the “neurobiological basis for cannabis withdrawal has been established via discovery of an endogenous cannabinoid system,

⁴¹ Nordstrom, 2007

⁴² Maldonado, 2002

⁴³ Smith, 2001

⁴⁴ Preuss et al, 2010

identification of cannabinoid receptors, and demonstrations of precipitated withdrawal with cannabinoid receptor antagonists. Laboratory studies have established the reliability, validity, and time course of a cannabis withdrawal syndrome and have begun to explore the effect of various medications on such withdrawal. Reports from clinical samples indicate that the syndrome is common among treatment seekers”.⁴⁵ In the most recent review the literature, Budney et al found several significant withdrawal symptoms associated with marijuana consumption. The Budney review examined the validity and clinical significance of a cannabis withdrawal syndrome according to the DSM-IV-TR criteria (which does not include marijuana withdrawal). Budney found that there are commonly observed symptoms in humans (see figure 4.1) that include anger, aggression, anxiety, decreased appetite, weight loss, irritability, restlessness and sleep difficulty, depressed mood, stomach pain, physical discomfort, tremors and sweating have also been reported, but occur less frequently⁴⁶. They conclude that the “cannabis withdrawal syndrome is reliable, valid, and clinically important and should be included in the next revision of DSM”.⁴⁷

4.3 Addiction Liability

There is little doubt that marijuana is associated with an addiction liability. However, the fact that marijuana is an addictive substance does not constitute grounds for government control via prohibition. Firstly, the ability to produce dependence effects is much less pronounced than alcohol, nicotine or pharmaceutical agents such as morphine,

⁴⁵ Budney,2006

⁴⁶ Ibid

⁴⁷ Ibid

Phenobarbital, and Valium, which are all used in the legitimate practice of medicine. Both clinical and epidemiologic research shows that cannabis dependence syndrome does occur in heavy chronic marijuana users. The risk of becoming addicted to marijuana has been estimated to be somewhere between 1 and 10 percent of those who use cannabis once⁴⁸. By comparison, 15 percent of alcohol users and 32 percent of tobacco smokers exhibit symptoms of drug dependence, and as such, marijuana's addiction liability is far less than many legal and illegal substances.⁴⁹ Marijuana is addictive, but it is important to measure the addictiveness of a drug against other substances. If one wishes to make rational policy, then we need a measure or standard to evaluate each possible policy option before creating rules and regulations. If one wishes to prohibit a substance simply based on the addictive nature of a particular substance in order to, for example protect individuals and their rights and freedoms, then alcohol, gambling, sex, tobacco and an array of currently legal substances or behaviors must be prohibited. This is obviously not what our government wishes to do, as this option is not only unreasonable, but prohibits activities based on a minority of individuals who are either vulnerable or stressed who become addicted to these behaviors and substances. A rational policy would be to compare the relative addiction severity of drugs and have standard or threshold in which certain activates that are highly addictive and will cause direct harm to others could be prohibited. If this is the standard that our government decides to restrict our freedoms, then obviously marijuana should be legal as it is well below the liability of other legal substances. Any other policy is irrational and arbitrary, and has no place in Canada law.

⁴⁸ Welch and Martin, 2003, Compton 2002, McRae, 2003, Elkashef et al, 2008

⁴⁹ Nordstrom, 2007

Another common argument made with respect to marijuana's addiction liability is that despite the stability in the overall prevalence of marijuana use, there is what seems to be a higher number of people who have marijuana abuse problems. For example, more adults in the United States had a marijuana use disorder in 2001-2002 than in 1991-1992. Increases in the prevalence of marijuana use disorders were most notable among young black men and women and young Hispanic men. Although other nationalities and races in the US have not experienced increased rates of marijuana dependence, the rates still remain fairly high.⁵⁰ Data from Western nations suggests that approximately 20% of clients entering addiction treatment programs report marijuana problems.⁵¹ This has been cited as a reason to prohibit marijuana, because it is addictive and there is an increase in the number of cases of those seeking help for their problems. In Canada, about 25 percent of clients are seeking help for marijuana addictions⁵². The first mistake in this line of reasoning is that the much greater number of marijuana users compared to users of other substances of abuse is likely the cause of these relatively high rates of marijuana dependence. In their review of marijuana dependence, McRae et al found rates of conditional dependence, that is the risk of developing dependence among those who have ever used a particular substance, rate of conditional dependence of marijuana was 9%, albeit lower than substances such as alcohol (15%), cocaine (17%), heroin (23%), or tobacco (32%)⁵³. Second, this line of reasoning also fails to consider the possibility that the increased number of people seeking drug addiction is a sign of improvement in terms of dealing with drug addiction. For example most of those seeking help for addictions are

⁵⁰ Compton, 2004

⁵¹ McRae et al, 2003

⁵² Ibid

⁵³ McRae et al, 2003

already on long waiting lists. For example, in Thunder Bay, Ontario, the waiting list for substance abuse treatment for youth is over 400 children long⁵⁴. Given that marijuana use typically starts in adolescence, with peak initiation around the age of 18⁵⁵, the increase in those getting treatment for marijuana addictions is *a positive sign*. Unless these facilities were already operating at capacity, then one may be concerned with the increases in marijuana use disorders. However, there are not enough resources available to meet even a fraction of those who are already seeking help. The increase in the prevalence rates of those seeking marijuana dependence problems can be seen as a sign that marijuana is becoming more problematic. However the fact that there is a growing acceptance of marijuana in Canadian society and that we are operating our drug treatment centers far over capacity and as Canada continues to increase finance for these areas, one can expect only to see further increases in the prevalence rates of marijuana dependence problems. If marijuana were legalized, the increase in marijuana related problems would only rise by the same fraction as demand would increase and if, and only if, there were no other government initiatives to help reduce, prevent, or care for marijuana dependence related issues. As marijuana abuse and dependence becomes better recognized as a significant public health concern, hopefully more research will be focused on the development of effective treatments for this disorder. A number of psychotherapies have been shown to be effective in helping people with cannabis use disorders, but no one therapy has clearly demonstrated superiority at this time⁵⁶.

⁵⁴ White, 2010

⁵⁵ Elkashef, 2008

⁵⁶ Nordstrom, 2007

4.4 Conclusion

In conclusion, Marijuana is addictive; it displays all of the characteristics that define an addiction. However, we do not prohibit substances on the sole reason that they are addictive. As previously mentioned, addictions require more than the drug. It is hard to establish a law based on the addictive nature of a drug, unless it was the degree of addiction, but then there should be many legal substances that are illegal such as work, alcohol and tobacco. In light of the evidence that marijuana is addictive, there still remains a question of economic costs. The costs of addiction are relative large, they are easily the most costly part of substance abuse, recreational users do not really impose that many problems on society, addicts can. Policy makers shouldn't be concerned with the addictive nature of marijuana, but the causes of addiction. 39% of Canadians with a mental disorder or substance dependence sought mental health services in 2001. Those with co-occurring substance dependence and mental disorders reported the poorest mental health when seeking care. In a recent analyses of the prevalence of co-occurring substance use and other mental disorders found that efforts under way to improve Canada's substance abuse and mental health services should continue to ensure that adequate attention is directed to the needs of people with co-occurring disorders. In a systemic review of studies regarding marijuana dependence treatment, found that that cannabis is commonly used as a stress-coping strategy and that *negative life events, trauma, and maladaptive coping* were all related to consumption of marijuana and other illicit drugs.⁵⁷ The use of marijuana for these purposes was most prevalent among chronic

⁵⁷ Hyman and Sinha, 2009

users. As previously highlighted in this report there are a subsection of individuals who either have: experienced life stressors, traumatic events, are subject to abuse and are impoverished, that seem to be more susceptible to addictions and many of the other problems that “arise” from drug use. The links attempting to give a negative view of marijuana are not grounded in rational theory. It seems more plausible that there are certain people who fall victim to developing substance problems because of unobserved factors. It is not the drug itself in entirety that causes addiction; marijuana is only one part of a larger puzzle on substance abuse. Those who support prohibition argue that it is the most costly and least effective means for solving these problems. In fact, it is impossible, on a large scale, for prohibition to reduce family abuse or any of the other factors that drive individuals to addiction, and therefore prohibition of marijuana cannot ever solve, for the most part, the problems of an addict.

5. Gateway Theory

The Gateway Theory is a common argument made by those who support the prohibition of marijuana. It is vital to consider the possibility of such a theory. In performing an economic analysis of the prohibition of marijuana, if the Gateway Theory is true, there exists a very strong, both moral and scientific, argument to prohibit and prevent people from using marijuana. As such, the existence of a Gateway Theory will cause users of marijuana (i.e. generally well behaved individuals who are using the drug for recreational purposes) to advance into other stages of drug use, including the

consumption of arguably much more dangerous substances which in themselves are highly addicting and can cause serious harm to both the user and society. The major empirical research that has examined the Gateway Theory in detail has found that there is a sequence or pattern in drug use, in that many of those who use “hard” drugs such as heroin, started out by using “softer” drugs such as marijuana. This section will continue by breaking down the particular aspects of this link and will show that the Gateway Theory has no scientific empirical or rational base, and should be discarded as an argument against prohibition.

5.1 Defining Gateway Theory

Although highly controversial, the Gateway Theory has had enormous influence on drug policy and legislation in many countries. The Gateway Theory has been a powerful argument in debates regarding legalization and decriminalization of marijuana. Eric Kandel originally developed the Gateway Theory in the mid 1970s as he found a particular sequence in the use of alcohol and drugs. The sequence he outlined approximately follows the pattern: people start the sequence with alcohol and cigarettes, moves to cannabis, and finally starts to consume “hard” drugs such as cocaine, heroin and LSD.⁵⁸ Cigarettes are a “gateway” to cannabis, which in turn is a “gateway” to hard drugs. This theory contests that becoming a user of one drug, usually a drug with less powerful effects and a lower propensity to addiction, causes an individual to be more susceptible to using other, stronger and potentially more addictive or harmful drugs; the theory proposes a number of mechanisms by which this may occur. The first is that the

⁵⁸ Kandel, 1975

‘gateway’ drug, usually cited as marijuana, does not provide a taste of the reward that the more powerful drugs do. Secondly, it is argued that people will build up a tolerance to the initial ‘gateway’ drug and as the effects of the drug become weaker the user must advance to more potent drugs in order to achieve the same level of ‘high’. Finally, those who support the existence of a gateway theory argue that by becoming involved with a group of people who either use or deal the gateway drug, the user will encounter a greater opportunity and/or social pressures to use different drugs.⁵⁹ In addition, Melberg et al, (2010) consider the possibility of an “adjustment cost effect: for some individuals consuming any illicit drug may cross a psychological threshold that makes it less costly to proceed into another stage of drug use”.⁶⁰

In 2002 Kandel expanded on the Gateway Theory and explained that there are interrelated propositions about sequencing (gateway). Drug sequencing is believed to be a fixed relationship between two substances. For example marijuana leads to cocaine is one fixed relationship, such that one substance is regularly initiated before the other. Association means that the initiation of one substance increases the likelihood of initiation of the second substance (i.e. using marijuana means one are more likely to use cocaine). The last proposition of the Gateway Theory is the most controversial and most cited in policy debates and in the literature, is a causation between the sequencing. This proposition suggests that consuming one class of drugs induces the consumption of other drugs, implying a gateway effect.⁶¹

⁵⁹ Pudney, 2003

⁶⁰ Melberg et al 2010

⁶¹ Kandel, 2002

In general, the consensus of the research is that there exists a clear association with marijuana use and harder drug use. Other research has found that early marijuana use by itself, even after controlling for other covariates, increases significantly the use of other illicit drugs.⁶² One study found that the prior use of both alcohol and cigarettes increased the likelihood of individuals using marijuana later on in life.⁶³ Finally employing an IV technique, one set of authors found that previous cannabis use increases the probability of subsequent cocaine use by 29 percent.⁶⁴ In a 25-year longitudinal study of New Zealand children, Fergusson and colleagues found that regular, or heavy marijuana use was associated with an increase risk of using other illicit drugs, becoming dependent upon other illicit drugs, and using a wider variety of other illicit drugs.⁶⁵ In addition research found that becoming a cigarette smoker increased the probability of becoming a user of cannabis, which in turn also increased the probability of becoming a user of hard drugs. This recent test of the gateway link also find that the gateway effect of marijuana is greatly reduced after taking unobserved heterogeneity into account, even to the point of not being statistically significant.⁶⁶ Recent studies have found that the statistical association between marijuana and harder drug user still hold, even when taking unobserved heterogeneous factors into account.⁶⁷ Even across national settings, marijuana users in many countries appear to have a significantly elevated risk for drug use progression, however, this risk finds that the risk of harder drug use is conditional on characteristics of the user, rather than the use of marijuana alone, therefore not providing

⁶² Lynskey, 2003

⁶³ Pacula, 1999

⁶⁴ DeSimone, 1998

⁶⁵ Fergusson et al 2006

⁶⁶ Beenstock, 2002

⁶⁷ Bretteville-Jensen et al. 2008

strong support for the casual gateway model.⁶⁸ The most recent paper on the gateway hypothesis builds on the previous work by using new methodical and empirical work in an attempt to further study the possible existence of a causal model. The paper argues that central to the idea of the Gateway Theory is the issue of unobserved individual heterogeneity between users. The authors argue that the work in this field should take into account time-varying covariates like prices and that it should make as few restrictions on the model as possible. Their conclusions from the empirical findings are “that the gateway effect of cannabis is statistically significant for a sub-group of ‘troubled youths’”.⁶⁹ Within this group, the risk of taking up hard drugs doubles after the initiation of cannabis. For most youth, however, the gateway coefficient was only statistically significant at a 10% level, and the marginal effect was relatively small. Still, the results indicate that the hazard for hard drug initiation would increase by one third during a 4-year “incubation period” following cannabis initiation.”⁷⁰ Their findings of a statistical significant gateway effect are, however, in line with recent studies using alternative approaches for taking account of unobserved elements. The literature over the last several years points in the direction that there is no causal link between marijuana and further drug consumption. Apart from the literature on the link between marijuana and other drugs, there are several problems imbedded in the research that also contributed to disproving the Gateway Theory.

⁶⁸ Morral, et al, 2002

⁶⁹ Melberg, 2010

⁷⁰ Melberg, 2010

5.2 Causality

The first major problem of the research on the Gateway Theory is that no one has been able to establish any form of concrete causality. The connection that is observed among those who study the gateway effect is a mere observation of transition from one drug to another; this does not necessarily imply a causal connection. Identifying the gateway effect is one of the many examples of finding the causal relationships in non-experimental data. It is tempting to view the correlations in the data between early marijuana use and subsequent use of other drugs, infers that marijuana use causes the future use of hard drugs. Without linking factors, there exists only a correlation, which does not give proper evidence for a Gateway Theory. If one were to make a policy based on simple correlations on drug use, one may then consider the research that found that there is an association between marijuana and media exposure. They found that music is associated with an increase in the risk of marijuana use. If an inference could be made on the basis of any statistical association, policy makers may want to consider music as part of the stepping stone process and ban music. This is obviously ridiculous, but goes to disprove that a simple correlation cannot be used to infer much more than a simple link. In addition, those who find the statistical association still cite that “the actual causal mechanisms underlying such a gateway, and the extent to which these causal mechanisms are direct or indirect, remain unclear”.⁷¹ Even with longitudinal data, the gateway effect is still difficult to explain correlation in terms of a causal model, while controlling for individual heterogeneity. Even with such longitudinal data there is evidence that the

⁷¹ Fergusson et al , 2006
Aaron Cayer 3363103 – “The ‘High’ Economics Benefits of Legalizing Marijuana in Canada

strong gateway effects are mostly due to the joint effects of unobservable person characters on the use of all illicit drugs rather than to causality.⁷²

It seems much more plausible that there are certain confounding factors that would lead one to step from one type of drug to the next. It is highly unlikely that anyone would want to use hard drugs once equipped with knowledge of the negative attributes which are commonplace among both youth and adults. Recent research has attempted to isolate some of the possible effects that may contribute to users moving from one drug to the next. It has been shown that proneness to deviancy and drug availability in neighborhoods promote the use of marijuana, which supports the idea of a common liability theory of substance use behaviour and substance disorder are in fact two sides of the same coin. Youth who have moved from the first stage to the second stage, of the Gateway Sequence, before the age of 22, seem to be more behaviourally deviant, were affiliated with deviant peers, were less involved in school, had friends who were not approved of by parents and were less inclined to make decisions to desist substance use.⁷³ These characteristics are the same of those who also have a high degree of social problems, substance abuse problems and mental illness. Obviously individual and environmental factors play a very important role in determining both the initiation of drug use and how far an individual will go along this chain. Factors such as the ones previously listed are a more valid link to explaining the gateway hypothesis, rather than placing blame on one particular drug; marijuana.

The next major problem is that the gateway hypothesis, unlike what most stereotypes define as the gateway sequence, does not actually start with marijuana and work through

⁷² Zhao , 2009

⁷³ Tarter, 2006

harder drugs. The consumption of drugs does progress in an orderly fashion through several stages, as the media and government argue. However, the entire sequence, which empirically is only exhibited by a small number of users, begins with beer or wine and moves progressively through hard liquor or tobacco, marijuana and finally hard drugs. Researchers have found a general common sequence consisting of: 1) initiation of alcohol or cigarettes 2) initiation of marijuana 3) increased levels of drinking 4) use of pills 5) increased levels of cigarette use 6) initial use of cocaine & initial use of other illicit drugs followed by regular use of marijuana.⁷⁴ The prior use of alcohol and cigarettes increased the likelihood of people using marijuana. One study, which assessed the relationship between cigarette prices and marijuana while controlling for cohort effects, found that people who grew up with cheap cigarette prices were more likely to use cannabis later in life and to initiate cannabis sooner. Their findings indicate a gateway effect from cigarettes to cannabis, both for sequencing and for timing. Interestingly, the authors propose that higher taxes on cigarettes (and possibly alcohol) would reduce not only cigarette smoking but reduce marijuana consumption as well.⁷⁵ This study found that people who are more likely to start smoking cigarettes also have a greater susceptibility to start consuming marijuana. However, they were unable to disentangle the relationship between the two, and clarify if it was exposure to the cigarettes that induced marijuana use or if it was some unobservable variable that linked the two.⁷⁶ The authors, also notes that is considerable evidence that youth start the 'path' with either alcohol or cigarettes

⁷⁴ Pacula, 1999

⁷⁵ Beenstock, 2002

⁷⁶ Ibid

(sometimes both) before moving on to both marijuana and/or harder drugs.⁷⁷ Also, it is very important to remember that the use of alcohol and tobacco by these underage individuals and therefore already prohibited, as such being illegal as had little effect on preventing youth from initiating drug use or the gateway sequence. Providing further evidence that the Gateway Theory is not quite what policymakers believe it to be. If one was to make the argument that marijuana is a gateway drug, then you must start with the first stage of this sequence, which are beer, wine and cigarettes. To pull a particular drug (i.e. marijuana) out of the sequence for no rational reason and argue that this is the cause of hard drug use is calamitous. If one believes that controlling marijuana will have a significant effect on controlling harder drugs, they may be actually doing more harm than good. In a study on the Gateway Theory, one study concluded that “with respect to the stepping-stone hypothesis the work is enough to suggest that we should look back to the spring under the willows or towards the bank of the stream to discover what pushes us from one stepping stone of drug use to the next. The gateway observations are incomplete without attention to the beginnings of the pathway that leads towards the modal gateway sequence, from most available to least available drugs.”⁷⁸

5.3 Reverse Relationship

Another argument against the existence of the Gateway Theory is that the reverse relationship does not exist. It is observed in research that the invariant ordering of youth

⁷⁷ Glantz, 1999

⁷⁸ Lynsky, 2002

initiation of drug classes, those users generally do not initiate hard drug use before marijuana. Furthermore it is important to note that the gateway effect or sequence of illicit drug use does not always hold for all users⁷⁹. Most users of harder drugs, such as heroin, LSD and cocaine have used marijuana, but the reverse is not true, most marijuana users never use another illegal drug⁸⁰. If the Gateway Theory were true, then there should be an observed relationship between increases in the consumption of marijuana over the last 30 years and a massive increase in the amount of harder drugs consumed. Cocaine use increased in the early 1980s, as marijuana use was declining. Over the last three decades, cocaine use has continued to decline, as marijuana use has increased slightly. It is interesting to note, because if there were a solid gateway theory, we would expect that with rising marijuana consumption there would be also a rising demand for cocaine, yet this effect has not been shown in any of the literature thus further disproving the existence of a Gateway Theory.

5.4 Individual Factors

It is likely that some gateway concepts seem plausible. It seems likely that any drug facilitates further drug use and it is reasonable to think that drug abuse would parallel the development of most deviant behaviours in moving from the soft to the harder drugs. In general, however, the increased risk finds that the risk of harder drug use is condition on a characteristic of the user, rather than the use of marijuana alone, therefore not providing

⁷⁹ Pacula, 1999

⁸⁰ Lynskey, 2003

any support for the casual gateway model.⁸¹ Another phenomenon research has found that supports the claim that marijuana gateway effect is that there is a strong relationship between the frequency of marijuana consumption and the risk of hard drug ignition, as the frequency of marijuana use increase so does the risk of initiating hard drug use. These relationships are not nearly enough evidence to prove that the use of marijuana, rather than any other factor, increases the risk of hard drug initiation. Morral et al use a simple common factor model to reproduce each of the above phenomena used to support the claim that marijuana acts as a gateway drug. Each of these results does not need the assumption of marijuana initiation or the opportunity to use is increase the risk of hard drug use or the opportunity to use hard drugs. Their findings demonstrate “the primary evidence supporting gateway effects is equally consistent with an alternative model of adolescent drug use initiation in which use, per se, of marijuana has no effect on the later use of hard drugs”.⁸²

5.5 Conclusion

The Gateway Theory has generally been dismissed by research. In their analysis of marijuana, The Canadian Senate found that: “The Stepping-Stone theory has proved unsustainable and lacking any real evidence base. The “evidence” that most heroin users started with cannabis is hardly surprising and demonstrably fails to account for the overwhelmingly vast majority of cannabis users who do not progress to drugs like crack

⁸¹ Morral, 2002

⁸² Morral, 2002

and heroin”.⁸³ If prohibition is based on the idea that marijuana is a gateway drug to further hard drug use, then the prohibitionist need to rethink their strategy. Furthermore, there are no rational grounds for an economic analysis of the Gateway Theory, there is no conclusive evidence that one exists, in the order that those who support the argument say it exists in. Furthermore the finding of this effect may not have even necessarily undermined the grounds to legalize marijuana. For example, if the driving force behind those who move to harder drugs is that they come in contact with these drugs because of contact through a drug dealer, a separation of the markets may decrease this effect. Also, if a government policy is to reduce hard drug use, a more effective means would be highlighting the real difference between hard and soft drug use and creating negative norms around the use of harder drugs, rather than attempting to prohibit marijuana in order to fight this problem. This downstream link does not seem like a good policy to fight hard drug use. If one wishes to reduce hard drug use, then focus on the root problems, not something associated with hard drugs. What does seem clear, however, is that there is a group more vulnerable to the effect of cannabis use on subsequent hard drug use. This group who reported hard drug use also reported more childhood problems.⁸⁴ Perhaps the early identification of “troubled youths” and adequate help to minimize the effect of their risk factors can be effective in reducing the number of hard drug users⁸⁵, rather than the irrational prohibition policy, based on the idea of a Gateway Theory.

⁸³ Nolan, 2002

⁸⁴ Malberg, 2010

⁸⁵ *ibid*

6. Marijuana and Crime

It is widely believed that drug use causes crime, and as such, many domestic and international drug laws are based on the idea that the enforcement of prohibition will indirectly reduce crime rates. However, this link is not wholly certain. The following section will review the literature on the link between marijuana and crime and will propose a number of arguments that disprove any notion of a link between marijuana consumption and increased crime rates.

Illegal drugs are inexorably linked with crime. The most frequent types of crimes associated with drugs are: crimes such as burglary and robbery (often to pay for drugs), trade linked to sex work, crimes related to drug markets (ex. 'turf wars' - battles over geographic parts of cities to sell drugs) and firearms offenses and crimes committed under the influence of drugs, as a result of the effects of drugs on the mind.⁸⁶ The two associations between crimes and drugs that are of key interest in terms of the drug-crime relationship, are that drug use causes individuals to turn to crime as a means of paying for their drug habits and that the drugs influence human behavior in a manner which causes individuals to commit crimes. The other types of crime are related to prohibition of drugs and not the drugs itself. If these drugs were legal, these crimes would not exist and therefore provide no argument for a connection between drug use and crime.

⁸⁶ Hughes, 2006

6.1 Drug Financing Crime

Prohibitionists argue that drug use (including marijuana), leads users to turn to crime to finance their expensive drug habits. There is little evidence that marijuana use causes such a financial hardship that user's turn to crime to finance such habits. Economic crime is that which is motivated by the need to generate income to fund a drug users own drug use.⁸⁷ By comparison with other illicit drugs, marijuana consumption does not typically produce compulsive patterns of criminal behavior among users and it is not as expensive as other illicit drugs. There is some evidence among youth that there are some economic motivations for crime.⁸⁸ However, youth tend to have smaller incomes and limited wants, resulting in many youth spend the bulk other income on only a few items. Teenagers primarily obtain their income from allowances, wages, and gifts⁸⁹, thus giving a greater incentive to commit crimes to fund not only drug consumption but also spending on all goods and services. Therefore, it is not necessarily the drug use that is causing youth to commit crimes; it is their limited budget and potential inability to find employment. Granted, youth do not generally commit crimes to finance legal habits, but without actually analyzing the data it could be true that in fact the same proportion of youth commit crime to finance a number of either legal and/or illegal activities. This would be more in line with the models of drug use that focus on the unobservable factors (i.e. poverty and unemployment) that motivate people to turn to either crime, violence and drug abuse. In terms of other "hard" drugs, this is not regularly the case. It is more

⁸⁷ Goldstein, 1985

⁸⁸ Pacula, 2000

⁸⁹ Markowitz and Tauras , 2006

common to find heavy users and users of hard drugs committing the highest frequencies of acquisitive crimes. In Ottawa, it is estimated that crack users typically commit upwards of 15 – 25 crimes per day.⁹⁰ The heavy end users involve people and groups living in social deprived areas, are typically unemployed, homeless, of lower social class. For these people drug use is a high financial burden on a low income. Of the empirical support for the many theories that predict that drug use will be associated with criminal behavior, most of the research support the idea that expensive drug use (such as heroin, crack, and cocaine use) is associated with commission of income-generating crime.⁹¹ However, the connection between marijuana use and income generating crime does not exist. Furthermore, one needs to check the relative cost of doing drugs to other recreational activities and/or addictions. If marijuana use were relatively more expensive or addicting, this would at least provide some indication that people might turn to crime to finance their use and/or addiction. Secondly, there are many activities that people engage in that are much more expensive, such as a love for collecting records, but the average person does not commit crimes to finance the purchase of more records. Therefore, there is no reason to believe that because something is expensive (of which recreational marijuana use is actually relatively cheap), that it causes people to turn to crime. There is no reason to believe that because marijuana is illegal, those purposing either the recreational use or who are feeding an addiction would turn to crime to finance their consumption of marijuana. Generally, people in society do not turn to crime to support other recreational and addictive substances and behaviors, such as shopping or gambling,

⁹⁰ White, 2010

⁹¹ Bennett, 2008

so why would individuals using marijuana turn to crime? There is no logical or reasonable explanation for this type of argument, and it does not support prohibition.

6.2 Behavioral Changes

The other major drug-crime connection is that prohibitionists argue that marijuana use in itself causes behavioral changes that induce one to commit crime. There have been a number of studies that show that arrestees and detainees have higher self reported rates of illicit drug use. A systemic review of the literature, found that there is a strong statistical connection between drug use and crime.⁹² They found that drug users were more likely than non-drug users to commit crimes and to commit crimes at a high rate, and that higher rate drug users were more likely than low rate drug users to commit crimes and to commit them at a higher rate. The most cited data in research regarding drug use in crime are the high rates of positive tests for illicit drugs for arrestees (see the below table).

Figure 6.1: Median Percentage of Positive tests among adult male arrestees in Various Countries.

	US	Australia	3South Africa
Cannabis	44	62	43
Opiates	6	12	3
Cocaine	30	2	5

Adapted from Bennet, Trevor and Holloway. 2007

⁹² Bennet and Holloway, 2008

6.3 Methodological Issues

One of the first studies on marijuana use and crime in 1974, called into question the methodologies of many of the studies that are cited by advocates of prohibition. He argued that marijuana use is not related in any meaningful way to crime. Although there exists the statistical association, marijuana does not seem to actually cause criminal behavior, promote aggressiveness or violent behavior. The authors argued that those who commit criminal acts are the same people that would be committing the acts regardless of the presence of marijuana and that individuals who would normally not commit crimes are unlikely to do so under the influence of marijuana. The research concluded that “available evidence points very strongly in the direction that the century’s old belief that marijuana causes crime is a complete myth”.⁹³ Although there is a clear statistical association between drug use and crime, the interpretations of such are not as clear. There is evidence that hard drug use can lead some people to commit crimes to support their habits, however, this can happen with many addictive substances including gambling. The addictive nature of the drug is only one aspect of the association between drug use and crime, there are a variety of confounding factors that lead one to commit crimes to fund a drug habit, and as such, the link is not so clear cut.

Since the initial arguments in regards to the connection between marijuana use and crime, there have been a number of studies attempting to establish both relational and causal models of drug/marijuana use and crime. In terms of marijuana use, the review of

⁹³ Goode, 1974

the literature on crime and marijuana, found that there was a positive and significant correlation between marijuana use and various measures of delinquency including aggressive behavior, property offending, and crimes against the person⁹⁴. However, the authors concluded that the strength of the relationship was not large, with the majority of the correlations being less than 0.3.⁹⁵ In a more recent major review, found that the odds of offending were about three to four times greater for drug users than non drug users, however results indicate that the odds of offending were highest among crack users, and lowest for recreational users.⁹⁶ The results indicate that marijuana and crime may not display the link that prohibitionists initially claimed. The other major review found that not only does the previous research show evidence of an association between drug use and crime, but also provides a quantitative measure of the strength of the relationship. The results show “that the relationship was not the same for all drug types. The greatest odds of offending were highest among crack users (about 6 times greater), second highest among heroin users (about 3 times greater) and third highest among cocaine users (about 2.5 times greater)”.⁹⁷ More importantly, they also found that there is a statistically significant association between recreational drug use and offending (the odds of offending were about 1.5 times greater for marijuana users and 1.9 times greater for amphetamines users). It is a widely held belief among those who oppose drug reform, that recreational drug use is associated with crime. In relation to marijuana and LSD, one study concluded that there was little evidence that either was linked to criminal behavior, although a statistical relationship can be found (see appendix – marijuana and crime). The

⁹⁴ Derzon and Lipsey, 1999

⁹⁵ Ibid

⁹⁶ Bennet and Hollow 2007

⁹⁷ Bennet and Hollow 2007

drug crime connection that prohibitionists advocated are different depending on the type of drug, with the harder drugs exhibiting the strongest links and the weaker drugs (marijuana) have the weakest association between drug use and crime.⁹⁸

The major models of drug use and crime predict a relationship that either drugs cause crime or the less widely believed model that crime causes people to do drugs. In a systemic analysis of drug use and crime, the authors found that “previous research has provided some evidence and strength of the relationship [drug use and crime], however, few systemic review of the research are available to help untangle the difference between studies”⁹⁹..The results of their research suggest that drug use and crime are strongly linked in terms of prevalence and incidence. Drug users are more likely than non-drug users to commit crimes and to commit crimes at a higher rate. The higher rate drug users are the most likely to commit crimes and commit them at a higher rate. Few studies actually assess the actual link between marijuana use and crime despite consistent findings that marijuana is the most commonly identified drug among arrestees. The first problem with these studies are purely correlational, there is no evidence to show that a causal model of drug use and crime exists. There are number of theories as to why crime and drugs could be linked together (Hughes, 2006, highlights the most recent), but the empirical work has yet to establish any connection behind the correlation between positive tests for drugs and arrestees. Furthermore, although the statistical link has been established, there are no studies that have shown any evidence that marijuana is actually a factor in the criminal committing the act.¹⁰⁰

⁹⁸ Bennet, 2008

⁹⁹ Bennet and Hollow 2007

¹⁰⁰ Hughes, 2006

In the most recent work that evaluated the link between drug use and crime, did in fact find robust associations between cannabis uses and later registered criminal charges, both in adolescence and in young adulthood.¹⁰¹ These links between marijuana and criminal activity were controlled for a variety of fixed factors including (but not limited to) family socio-economic background, parental support and monitoring, educational achievement and career, previous criminal charges, conduct problems and history of cohabitation and marriage. After the adjustments, there was still a link between marijuana use and later convictions, however once they eliminated all types of drug specific charges, there was no longer any significant association with marijuana use and crime. However, the bulk of the link between marijuana use and criminal activity is related to the various types of drug specific crime (possession, importation, production and trafficking), therefore disputing the evidence of any type of real association between marijuana use and crime. Even using longitudinal data, the relationship between marijuana and later crime seems to be non-existent and/or very weak in the case of marijuana than for many other substances, including legal ones, such as alcohol¹⁰². Alcohol consumption interestingly enough, is related to violent behavior and crime, but this link is often failed to be cited by either side of the marijuana reform debate. If one were going to prohibit the use of a substance because of a link between crime and consumption, it would be beneficial to start by prohibiting the consumption of alcohol. Also considering that most of the connection between marijuana and crime is due to drug

¹⁰¹ Pedersen and Skardhamer, 2009

¹⁰² Pedersen and Skardhamer, 2009

specific activities, the legalization or decriminalization of marijuana and/or other illicit drugs could in fact and is likely to reduce crime.

In addition, there are two reasons as to why inferences about marijuana use and crime should not be inferred from the empirical finding that more criminals are using drugs. First, most of the empirical work is based on urine tests of arrestees, most of the criminals who test positive for marijuana also test positive for other illicit drugs. It would be near impossible or ethical to conduct research to separate the effects of each of the specific drugs. The use of the other drugs may be what motivated the criminal behavior other than the marijuana and little is known as to what extent multiple drugs will cause change in behavior. It is plausible that other drugs or substances act as a catalyst for any number of other legal or illegal substances that could possibly change how one particular drug will effect an individual. Furthermore, unlike other substances such as alcohol (which is almost completely gone within 48 hours of consumption), a positive urine sample for THC indicates use in the past month; it does not mean that marijuana was used prior to, or during the offence that took place. Therefore, a positive result for THC in urine samples cannot be strong evidence that the crime was committed under the influence of marijuana.¹⁰³ Also, these studies do not generally consider the type of crime that people have been committed of. Some of the arrestees and detainees were being charged with drug related crimes, no wonder they have marijuana or other drugs in their urine samples! This line of reasoning fails to make any substantial point regarding crime and drug use. Given that marijuana can be identified in urine for up to 30 days past the time of consumption suggests that individuals who engage in violent crimes are also

¹⁰³ Pacula, 2003
Aaron Cayer 3363103 – “The ‘High’ Economics Benefits of Legalizing Marijuana in Canada

likely to engage in marijuana use, but the marijuana use is not necessarily related to their decision to engage in crime.¹⁰⁴ If one were to test criminals for either other behaviors or substances in a 30 day period before being arrested, one would expect to find a number of behaviors and substances that would have high frequency rates among arrestees, such as driving over the speed limit. This could have been correlated across time to show a longitudinal relationship, these correlations do not infer that there is a link between crime and dangerous driving, without proper causal links to match the statistical links. The same rationale applies to the correlations between marijuana use and arrestee data.

The next major issue in relation to drug use and crime, is that those who are convicted of crimes that either have used drugs or are drug users/abusers are also the same groups that are more prone to becoming addicts because of their increased prevalence of abuse, lack of social networks, social exclusion, lack of education, stress and vulnerability. It is no wonder that for these people, acquisitive crimes and trade linked to drug use will be used to finance drug use (as well as finance basic life needs such as food and shelter). The current policies on drug prohibition are based on these basic assumptions about crime and drug use, but fail to see the wider dynamics underpinning drug use and criminal activity.¹⁰⁵ A significant proportion of offenders have psychoactive substance abuse problems, predominantly with alcohol, in fact most alcohol abuse is the most frequently cited source of cause [in relation to substance abuse] for violent crime¹⁰⁶. Marijuana use and criminal behaviour may also be associated because both behaviours are driven by a common cause, such as personal characteristics of

¹⁰⁴ Pacula, 2003

¹⁰⁵ Hughes, 2006

¹⁰⁶ Nolan, 2002

individuals that motivate them to become involved in both behaviours. It may be the case that substance use reduces an individual's ability to get away with a crime rather than influencing the likelihood of committing a crime. It may be the case that marijuana use causes individuals to participate in these crimes or it may be the case that marijuana use increases the likelihood that offenders get arrested for these crimes. In particular, it may be true that this association arises because of the selection factors associated with both cannabis use and crime. For example, marijuana use in general has been linked to childhood and family disadvantage, educational problems and underachievement and early-onset conduct problems¹⁰⁷. It is much more likely that these behaviours are the actual link between crime and drug use, not the use itself. It takes little more than examining the acute effects of marijuana use to see that it is highly unlikely that marijuana users will be committing crimes, based on the acute physical and psychological effects of marijuana use.

6.4 Conclusion

These findings suggest that the recent focus on marijuana law enforcement has been counterproductive for addressing non-drug crime. The results imply that non-drug crime rates may decline because law enforcement resources may be directed against other criminal activity when marijuana arrests are given lower priority. In addition, users would not have to finance higher priced marijuana purchases related to supply disruptions, and sellers would not pursue alternative crime opportunities if the risk of arrest for the sale of

¹⁰⁷ Rob, 1990, Tu 2008, Terry and McElrath, 2009
Aaron Cayer 3363103 – “The ‘High’ Economics Benefits of Legalizing Marijuana in Canada

marijuana declines.¹⁰⁸ Furthermore, if there exists a relationship between marijuana use and criminal activity, why do we need to find the reverse relationship between marijuana and crime? There is no evidence that most marijuana users are criminals, this is extremely important. The vast majority of marijuana users do not commit crimes (unless they are just not getting caught, then they are just good criminals!). As of now, the current research looks at the risk of offending among marijuana users and those who have already committed crimes, but for the most part, those who use marijuana for either recreational use or even chronic users, *do not engage in any sort of criminal activity*. There is no need to evaluate the claims made by those who support current marijuana laws that marijuana is intolerably linked to criminal activity and or behavior.

7. Marijuana and Violence

It has been speculated that marijuana use is associated with aggression and violence. In the early part of this century, the U.S. government promoted the image of a crazed lunatic using marijuana, becoming extremely aggressive, committing violent crime and even murder¹⁰⁹. The relationship between drug use and violence is not clear, and the research into the role that marijuana plays in aggression and violence has resulted in very mixed conclusions. The importance of such a link would be a strong argument for the prohibition of marijuana. Furthermore, in an economic analysis of marijuana laws, if this link existed, it would represent a direct link to third party harm. This link could

¹⁰⁸ Shephard, 2007

¹⁰⁹ Moore, 2008

potentially increase the costs of marijuana reform and would dampen the positive aspects of marijuana law reform. This section will review animal studies on marijuana use and violence, review some of the human studies on marijuana use and violence, will assess the argument that violence is linked to obtaining illegal substance, will consider the confounding factors which may undermine the violence-marijuana relationship, assess the link between marijuana withdrawal and violence, assess the link between cognitive impairments and violence and draw attention to a heuristic model of drug use and violence.

7.1 Animal and Human Studies

For the most part, studies involving animals and laboratory studies on the effects of both acute and chronic administration of marijuana show that there is no effect on aggression or violence. Furthermore, acute administration of THC on a number of different animals actually suppressed attack and threat behaviours and increased flight responses in a variety of species.¹¹⁰ Translating the results to humans suggests that what is more important than the biological underpinnings of how THC cannabinoids effect the human brain, are that external exposure to certain environmental stressors may have a more profound impact on aggression, and that cannabis may not be associated with aggression. It is extremely important to consider studies outside of the laboratory on marijuana and aggression, as this potential between environmental stressors and

¹¹⁰ Miczet et al 1994

marijuana aggression has a number of important implications for understanding marijuana and substance abuse.

The results of past reviews of both anecdotal and empirical studies on the relationship between violence and marijuana in humans are mixed, some reviews of the literature report that the weight of the evidence suggests that marijuana is not related to violence, except in rare cases.¹¹¹ At the same time there are other reviews that evaluated the research that marijuana use and violence and concluded that the consumption of marijuana is associated with an increased risk of violence.¹¹² The most recent review concluded that there exists a positive association between marijuana use and interpersonal violence; although data from laboratory studies on THC administration and aggressive behaviour are mixed. That there still exists support for an association between these variables that are linked with marijuana use and violence.¹¹³ There is no overriding clear conclusion on the use of marijuana and violence, however if we assess each of the major arguments proposed by those who find an association between the two, the relationship between marijuana and violence trends to fall apart.

7.2 Methodological Issues

Even, if laboratory scientific research tells us that there is no link between marijuana and aggression, we still cannot jump to conclusions that there is no link between marijuana and aggression, the results of this type of research show us that there

¹¹¹ Miller and Potter-Efron, 1989, Taylor and Hulsizer, 1998

¹¹² Bushman, 1993, and Sussman et al 1996

¹¹³ Moore, 2008

is no biological basis for marijuana and aggression, that the drug itself is not responsible for many of the violent behaviours that opponents of marijuana policy reform wish to attribute to the consumption of marijuana. Instead it is the confounding factors of everyday human existence that cannot possibly be reproduced in a laboratory setting that account for the link between violence and aggression. If this is true and policy makers wish to attack the root of the problem, then focusing on banning the supply of marijuana will not mitigate the issues of aggression and violence. Although an argument could be made that resolving the environmental stressors would be too complex, and that the easiest route to helping people would be banning the consumption of marijuana, it would still require a careful analysis of the resources devoted to the costs and benefits of a prohibition policy. If the costs of prohibition outweighed the costs of addressing the root problems in this type of context, prohibition policy would be ineffective.

The first issue in the research between marijuana and violence is that a substantial amount of the investigation focuses on the notion that violent behaviour occurs in the context of obtaining substance, the notion that drug use leads to crime and that violent behaviour occurs within the system of an illegal substance (disputes over territory, collection of debts). These violent problems are not a result of the use of the drug, in the previous section of this paper we concluded that there is no real link between the consumption of marijuana and crime therefore disputing the above arguments. Furthermore the idea that violence is encouraged in the context of the system of an illegal substance, are consequences of the fact that these drugs are illegal, not on the basis of the drug or the individuals involved in the consumption of said illicit drug. A substantial part of the evidence on the association between marijuana use and violence is based on the

prohibition law and should disappear, if not at least vastly reduced, if these substances were legalized. There is evidence that full legalization will reduce or eliminate organized crime and the violence associated with it, the American mafia operating prostitution and gambling rings in Holland, left in 1986, when the government of Holland passed the Games of Chance Act, they officially legalized gambling. After the enactment of the law, the government stepped in to control and regulate the supply of gambling across the country, they started organized lotteries, there was not much left for the gangster to do, so they packed up and left.¹¹⁴ The relationship between marijuana use and crime cannot be supported by the fact that it is illegal to obtain marijuana and that violence occurs in this context. This is a cause of prohibition, not a consequence of using or obtaining marijuana.

In terms of the research between marijuana use and violence research has found a strong association between marijuana use and interpersonal violence. However, this relationship is associated more with substance abuse rather than recreational use of marijuana. There is some evidence that drug abuse and drug related problems are associated with increases in aggressive behaviour between intimate partners, with cocaine emerging as the illicit substance with the strongest relationship to all forms of aggression, however marijuana use is also associated with partner aggression.¹¹⁵ This relationship between drug abuse, violence and aggression is not surprising. Drug misuse is one of the leading mental disorders in the world, with links to aggression, family problems, abuse and a host of other factors. The link between marijuana abuse and violence is nontrivial, there will always be issues surrounding the abuse of any substance or behaviour. For

¹¹⁴ Collins, 1999

¹¹⁵ Moore, 2008

example addictions to gambling almost always are linked to a variety of marital problems and money management is the number one reason for divorce in North America, the abuse of gambling is problematic, as any addiction or misuse of a substance will be.

Data and research from questionnaire, survey and mortality studies generally support a relationship between marijuana use and violence. However, it is important to note that a number of these studies report on marijuana-dependent and more frequent users of marijuana report exhibiting more aggressive behaviour, more so than recreational and non users. Some of these studies used data from prison and inner city samples, which may be biased for several reasons, including that these samples are more prone to violent behaviour and the environmental stressors.¹¹⁶ Those who experience stressors, such as economic circumstances and neighbourhood contexts increase the likelihood of drug and marijuana use¹¹⁷ and that differences between drug users and non drugs, is related to variation in social circumstances and responses to disadvantaged social status.¹¹⁸ The relationship between drug and or marijuana abuse and violence is not surprising. However, this data needs to be interpreted correctly, such that drug abuses are generally more violent and have similar unobserved characteristics, which are more likely to be the cause of the violence, rather the marijuana use itself. As highlighted already in this report, there are similar factors which lead to crime, violence and addiction. These factors are important in understanding and explaining violent behaviour, not simply that they are users of marijuana. Furthermore, drug abusers only represent a small fraction of those who use drugs. These people are those who are more likely to display violent

¹¹⁶ Tarter, 2006

¹¹⁷ Hatch, 2007

¹¹⁸ Sutherland & Shepherd 2001

characteristics. It is not logical to create policy for a minority few of users, whose problems with drugs is only one small factor in explaining their violent behaviours. It would be much easier from a policy perspective to focus on the root of the problems, rather than infringing on the rights of so many, in order to potentially reduce violence among a marginalized group of people.

7.3 Withdrawal and Violence

Other studies on the link between marijuana and violence have also indicated that there may be an association between marijuana withdrawal symptoms and aggression, in reviewing the withdrawal studies, there is support that there exists a withdrawal syndrome, and those who abstain from using marijuana clearly experience unpleasant effects, such as agitation , appetite changes, sleep disturbances, and irritability, which in themselves can increase the risk of violence. However, the opposite effect is plausible that some people may use marijuana for a reducing negative effect, if so marijuana use may decrease a risk for violence.¹¹⁹ Withdrawal symptoms are one aspect of drug addiction, as stated previously drug abuse and the recreational use of marijuana is very different. There isn't widespread support for an association between recreational marijuana use and violence. Withdrawal from any addiction, is usually accompanied by a number of side effects, those, which are associated with marijuana, are some of the 'easier' withdrawal symptoms to handle. The fact that withdrawal from marijuana is

¹¹⁹ Moore, 2002

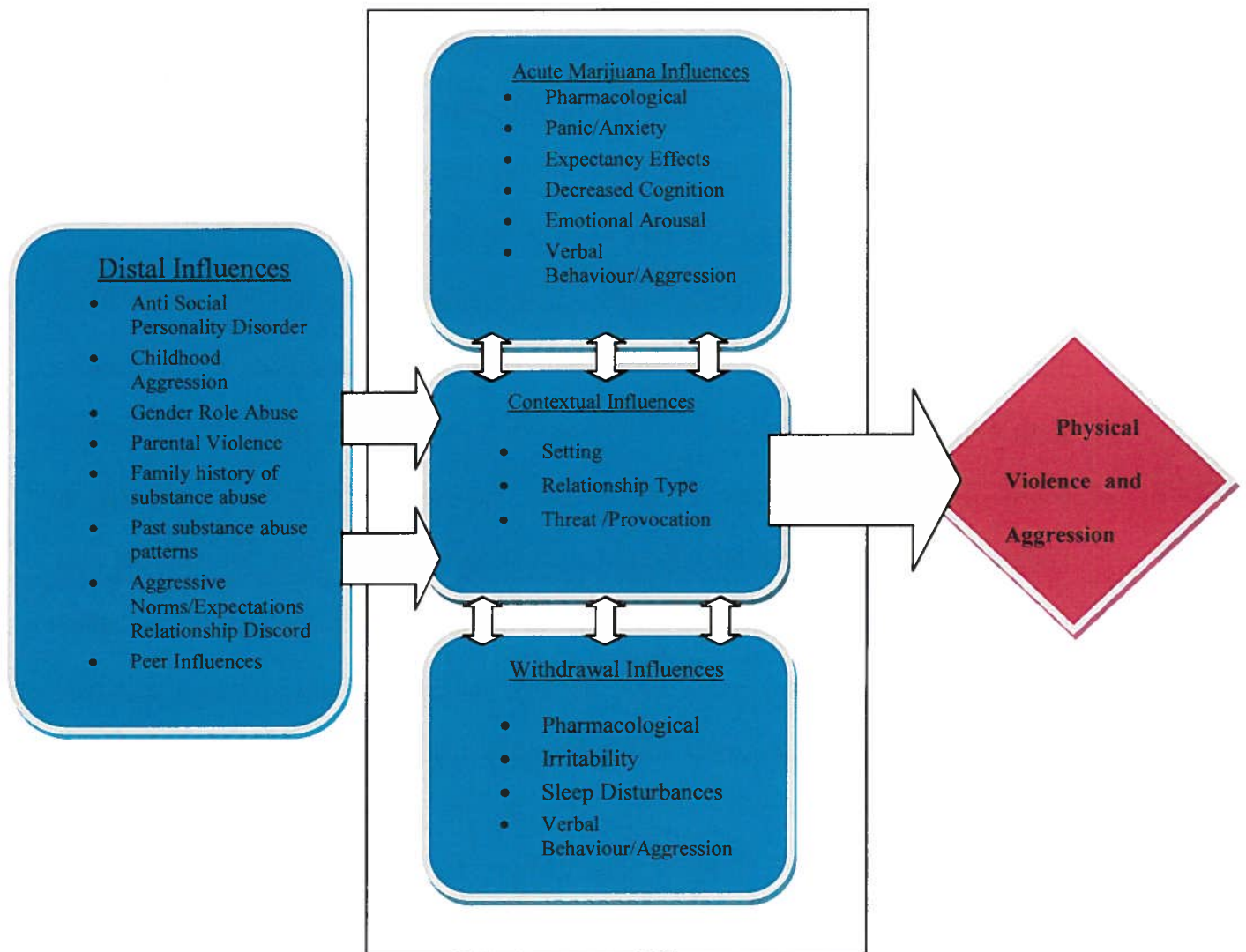
linked with increased risk of violence does not support the notion that using marijuana will cause violence and it not a decent argument for prohibiting marijuana.

7.4 Cognitive Impairments and Violence

Cognitive impairments that are associated with the use of marijuana, may have implications for explaining a possible link between marijuana use and violence, for example chronic use of marijuana may decrease the ability to attend to complex issues that are present in interpersonal conflict, the smaller attention spans in, for example martial partner arguments, may be a migrating factor in promoting violence and or aggression¹²⁰. This line of reasoning is the only area of research that has shown a rational explanation for possible increases in violence among those using marijuana. However, taken in context, the links depend still on the involvement of a number of parties, that may invoke the violence, and it is not accurate to blame marijuana, as the sole product, for producing violent behavior among some users.

¹²⁰ Moore, 2005

Figure 7.1, Biopsychosocial model of Marijuana and Interpersonal Violence.



Source : Adapted from Chermack and Gioancola (1997) and Leonard (1993) in Moore, Todd M and Stuart, Gregory L. "A Review of the Literature on Marijuana and interpersonal Violence". Aggression and Violent Behaviour 10 (2005) 171 – 192.

The above figure is a heuristic model of has been adapted from models alcohol and marital aggression and marijuana and interpersonal aggression and violence to summarize the distal and proximal factors that may be etiologically related to violence. Marijuana intoxication is one part of a heuristic model which leads to increases in the likelihood of violence. These distal, acute marijuana effects are contextual and withdrawal influences may all play an equally important role in the occurrence of violence. Furthermore, this type of model of marijuana use and violence allow for the possibility that these factors can also leads to the possibility that marijuana use may decrease the propensity violence. Although not empirically tested, this model does incorporate as much as the recent research into marijuana and aggression in an attempt to explain the fundamental relationships between marijuana and aggression. Moore, in their review of the model and research conclude that “marijuana use may increase the risk for violence among particular individuals in particular contexts. Thus, we contend that marijuana use *is neither necessary nor sufficient* in predicting violent behavior, but rather that acute marijuana intoxication may alter psychological/cognitive, physiological and interpersonal variable that increase the likelihood of violence in certain contexts”.¹²¹

7.5 Conclusion

The most recent literature is further raising doubts about the nature of the relationship between marijuana and violence, the largest study to date investigating aggressive behaviour among long-time adult concomitant marijuana and alcohol users;

¹²¹ Moore, 2005

used a structural equation model (SEM) to examine the relationship between marijuana use and aggression. SEM illustrates complex relationships among variables such as multiple dependent measures and indirect effects. They found that, even when taking into account confounding factors (such as alcohol, history of hard drug use, gender and age) self reported aggression following marijuana use was less than aggression following the consumption of alcohol and that there was no relationship between recent marijuana use and aggression.¹²² They conclude, “due to the large-scale nature of our study, we should have been able to detect a relationship between marijuana and aggression if such a relationship existed”.¹²³

8. Organized Crime and Marijuana In Canada

The following section will outline marijuana and organized crime in Canada, show that organized crime is driven by consumer demand, show that the risk premium for suppliers creates a black market for marijuana, analyze the link between crime and prohibition, assess the link between prohibition and violence, and will outline some of the negative, unmeasured socio-economic impacts of organized crime.

¹²² Denson and Earleywine, 2008

¹²³ Ibid

8.1 Marijuana in Canada

The marijuana industry in Canada is a huge market generating billions of dollars and employing thousands of people. In the 1970's before the explosion in production of marijuana, the production of marijuana was basically free of criminal involvement. Unfortunately that has changed, such that marijuana cash crops are now a staple of any organized criminal organization in Canada. From the Vietnamese street gangs to the Hells Angels (one of the contributing factors which gave rise to the Hells Angels was revenue which poured in from illegal drug sales), these criminal activities are highly organized, and they control all aspects of the business; from the supply of equipment to fertilizers to money to finance operations.¹²⁴

8.2 Demand

By the end of the 1990's there have been thousands of illegal grow operations documented across the country¹²⁵. With a relatively small investment, a grower can reap profits well over 1 million dollars by the end of their first year in operation. Throughout much of the 20th century Canada has been importing foreign marijuana. In recent years however, *supply has been able to adequately meet demand* and, we have started to export Canadian marijuana to the United States. RCMP figures indicate that between 1994 and

¹²⁴ Beare and Schneider, 2007

¹²⁵ Mulgrew, 2005

2002 the amount of domestically grown marijuana seized in Canada grew more than 600 %.¹²⁶

The trafficking of illegal drugs is one of the most significant criminal activities of organized crime. In the United States, in 1995, Americans spent 57 billion dollars on illegal drugs; the majority smuggled and trafficked by illegal organizations¹²⁷. Organized criminals produce and distribute illegal goods, and services to those who are willing to pay. Illicit activities involve trafficking drugs, running illegal gambling operations, involvement in the sex trade, and smuggling. It is a profit driven enterprise; thus a requirement for the development of the crime enterprise are laws that prohibit the production and consumption of various goods and services that are *mala prohibition*. Drug trafficking arises due to the prohibition of drugs; it is an activity that involves the importation, manufacturing, cultivation, distribution, and/or the sale of drugs. Drug trafficking involves a social network of crime, in which several people negate in a variety of illegal commercial activity for profit on an ongoing basis. Contrary to popular belief most studies have shown that the sale of drugs have focused on retail or street sales and that the idea of a “pusher” presented by the government and authorities is not true. Drugs are not ‘pushed’ according the popular image of an evil man lurking about in a high school, but they are sold to friends and acquaintances by a large number of independent drug dealers, they are simply satisfying *consumer demand*.

Due to recent advances in hydroponic technology and the efficiency of organized crime, Canada has become internationally renowned for growing powerful marijuana.

¹²⁶ Beare and Schneider, 2007

¹²⁷ Liddick, 1999

Hydroponic systems are being used on a large scale to grow marijuana and unlike external grow operations, hydroponic cultivation can be used anywhere regardless of growing season.¹²⁸ The increases in potency have lead to an increase in the demand by US consumers for Canadian grown marijuana. The high demand for Canadian marijuana results in a substantial price increase as soon as the drugs cross the border; this further adds incentive for Canadians to become involved in the illegal drug trade. In addition, with the introduction of NAFTA, the returns for drug traffickers and organized crime has become even greater. Free trade agreements, such as NAFTA create new (and should have been expected) opportunities as the increase in illicit trade and subsequent reduction in border checks provide additional cover. In North America, NAFTA has opened the floodgates between the US, Canada and Mexico, and has facilitated the rise of the Canadian marijuana exportation business and the Mexican Drug Cartels.¹²⁹

People generally only enter into the drug trade for one reason-the ample profit. A small time drug importer in Canada can make anywhere from \$40 to \$80 thousand a month, while a larger scale importer or producer can make upwards of \$50 to \$70 thousand a *week*. This income is strictly cash, making a medium sized organized crime members able to make a million after tax income yearly, with no skills or education, In fact one small time importer was quoted as saying “Its easy, though, ... , it’s like ... it’s almost boring. I would get a kilo for two grand US and let it off right here for like 30 grand. Subtract my costs and I’m still making a killing”. The incentives to drug dealers are huge, prohibition policy, in order to deter drug trafficking, needs to be enforced to the degree to remove the risk premium and incentives from the system. Two problems arise

¹²⁸ Kenneth and Zhao, 2009

¹²⁹ Liddick, 1999

with this policy. First current enforcement techniques have been unable to impact and or reduce the risk premium and the profit incentives on any significant level. More importantly, even if police and government were able to detain drug dealers and restrict the supply of illicit substances, the risk premium will only continue to rise and induce more people to become drug producers and traffickers, thus creating a viscous endless cycle which cannot possibly solved through prohibition.

The last piece of evidence that gives rise to a risk premium, and creates massive incentives to create illegal markets in the existence of prohibition is the effect of alcohol prohibition in the early part of this past century. It has been argued that when alcohol was prohibited, supply did not actually shift, as many economists predicted it would; it simply changed from legal to illegal sources. In the short run, there could not possibly be an instant change in consumer demand such to accommodate a change in prohibition laws. In terms of the alcohol prohibition, alcohol is and has been part of many cultures, and has been consumed for thousands of years. The assumption that supply and demand would shift may be correct in theory, but failed in practice. What seemed to happen during the prohibition of alcohol was that there was a disconnect between supply and demand. Which created a massive incentive for someone to illegally provide what was legal before, and to supply the good in an underground context. Prohibition creates a new profit opportunity for those involved in organized crime, which may increase or alter the types and frequencies of crimes they commit.

8.3 Organized Crime and Drug Trade

Those who oppose the marijuana reform argue that there is a connection between crime and marijuana. This connection is related to the prohibition of a substance and crime. It is not the drug that is causing crime; it is the act of prohibition itself. Prohibition can result in more, not less, crime and corruption. With any prohibition there is a rise of a black market, these markets already represent institutionalized criminal exchanges, involved in corruption, violence, bribes, extortion, gambling and prostitution.

Another major way in which drug prohibition is linked with crime is that criminals must use other forms of conflict resolution, rather than the justice system. Violence is typically used against other criminals and those who are unfortunate to be in the way of solving conflict. Criminals use violence to seek revenge, facilitate robberies, to collect debts, and in conflict over territory and/or customers. Criminal dealers report that a reputation for violence in the underworld will prevent problems and diminishes the need for coercion. Many drug dealers, who were interviewed while serving a sentence for trafficking, stressed the importance of violence in organized crime. If one chooses not to actually use violence as a means of conflict resolution, one must at least have the appearance of being able to use violence.¹³⁰

There are actually a number of natural policy experiments that have occurred in which information can be extracted on the violence-crime relationship in regards to prohibition. The first is that of the impact of Alcohol Prohibition on the murder rate, the

¹³⁰ Desroches, 2005

study on the impact of violence on homicide rate found that there were increases in the murder rates in the US after the prohibition of alcohol. The authors concluded, “the only beneficiaries of Prohibition were bootleggers, crime bosses, and the forces of big government”.¹³¹ Other serious crimes rose in the same period, including robbery, burglary, assault, etc. All fell with the repeal of Prohibition. One of the more important consequences of Prohibition was the rise of *organized* crime. All of these increases in crime came with minor effects on consumption (see, e.g., Miron and Zwiebel 1991 and Thornton 1991).

The data on homicide rates in the US, over the last 100 years show two significantly marked increases and peaks. The homicide rate was in the 1919 – 1933 period when constitutional prohibition was in effect, and in the 1970 – 1990 period when prohibition was strictly enforced.¹³² This data does not necessarily mean that there is a link between prohibition and violence (as it is just a correlation), although backed by solid theoretical and rational reasoning; the increases are as early as 1906.¹³³ Studies have examined the expenditure for enforcement on prohibition and have found that there exists a strong relationship between prohibition and violence (see appendix – Organized Crime). There is a relationship between violence from organized crime and prohibition, and that decreases in expenditures on prohibition are a contributing factor in reducing violence and crime. The results suggest that reducing drug prohibition could decrease the homicide rate anywhere between 25 and 75 percent of course, the reverse relationship can be true as well, but seems unlikely that crime increases and enforcement expenditures

¹³¹ Thornton, 1991

¹³² Miron, 2004

¹³³ Ibid

follow suit; given the nature of the underground black markets and organized crime involvement in drug markets.

In a more in depth cross country statistical analyses on the relationship between prohibition and violence across countries that enforce prohibition to varying degrees, violent and homicide rates differed across a number of countries. Many of the European countries that generally have more lax laws regarding prohibition also had lower rates of violence than their North American comparable counterparts. Furthermore, the US had a per capita homicide rate, which is between 5 and 9 times the rate in almost all of the western style developed countries¹³⁴

The other natural policy experiment was when Alaska recriminalized marijuana in 1990. Violent crimes in Alaska increased dramatically after marijuana was recriminalized in 1990, as shown in appendix – organized crime. By 1995, violent crimes had increased *by just over 100%*.¹³⁵ If prohibition *worked*, one might argue that these costs were tolerable. But because prohibition *fails*, these costs are in addition to any social costs that actually stem directly from marijuana use. Although there has been no extensive analysis into the impact of decriminalization and violence in Alaska, the initial evidence seems to coincide with the view that violent crime (from organized crime) is linked to the prohibition of illicit drugs (marijuana).

¹³⁴ Miron, 2001a and Miron 2001b

¹³⁵ Bates, 2005

8.4 Organized Crime Impacts

There are a number of negative impacts of organized crime, which stems from drug trafficking, is the effects on youth. Illicit drug use and abuse has the highest prevalence rates among youth. One of the negative impacts of prohibition is that the youth may be drawn into criminal activity by means of relationships to their drug dealers. As youth are inexperienced and more susceptible, it is much easier for organized crime groups to attract and recruit youth, this is particularly true of street youth.¹³⁶ Economic measures of organized crime do not account for the unmet potential of youth who go on to either abuse drugs or engage in further criminal behaviour. The impact of such costs is not isolated to just the youth that become involved in criminal activity, but extends to their family, friends and communities.

Corruption and bribery have been and will always be a key tool of organized crime. In Canada police and private sector individuals are rarely caught in scandals involving organized crime. There have been no major cases of corruption amongst the higher level political and business officials, but given that they are often involved in a variety of other types of scandals and given the prevalence of corruption in other nations, there is no reason to believe any different.

Organized crime also controls much of the drug trade in Canadian correctional facilities. In a 1997 survey of inmates in Canadian correctional institutions, 12% tested

¹³⁶ Porteous, 1998

positive for illicit drugs.¹³⁷ Although it is possible that many are using these drugs for recreational purposes or to cope with the severe negative consequences of being imprisoned, there are some inmates who are addicted to illicit drugs. Part of the imprisonment process is to rehabilitation and reintegrate into society, if the arm of organized crime reaches out and supplies these inmates with drugs to feed their addiction this serves to undermine the entire process of rehabilitation and only fuels their substance abuse problems, which is possibly a large factor in why these individuals are involved in the criminal justice system in the first place.

Finally organized crime and the drug trade have a number of negative impacts on local communities. For example, often rental properties are used for the purpose of marijuana grow operations. This may inhibit poor families from finding adequate rental accommodations in communities where rental housing is either limited or prices are inflated by the large payments organized criminals pay landlords.¹³⁸ Marijuana grow operations also steal hydro from surrounding neighbors living in close proximity to the grow operations. There have been many cases of serious mold that has developed as a result of the grow operations and has been harmful to future buyers. The units typically used for grow operations generally need massive renovations, sell for below market value and degrade the local property values. Finally, investors who have purchased grow operations without knowledge of, can have their property seized and lose all of their investments. Finally, often in drug trade, instead of cash guns are imported for Canadian

¹³⁷ Porteous, 1998

¹³⁸ Richter, 2003

Marijuana¹³⁹, which get trickled down to local gangs and street criminals promoting further violence and problems among already marginalized communities.

Finally because marijuana is illegal it is not subject to the normal economic elements that in a free market would normally and naturally control and regulate both quality and quantity^{see note}. It is natural to assume that many of the reasons for the increases in potency and the negative consequences of such can be directly attributable to the control of marijuana supply by organized crime.

8.5 Conclusion

The results of the above anecdotal and empirical discussion on organized crime show the link between prohibition of illegal substances and criminal behavior.¹⁴⁰ Given that violence and crime are a part of illegal organizations, and there exists a positive relationship between the degree of prohibition enforcement and violence and crime. Furthermore, it is well documented that those who play a role in drug trade are sometimes

¹³⁹ Schneider, 2009

^{see note} Protection of the consumer against “dishonest and unscrupulous business practices” (such as marijuana potency) does not always fall within the grasp of government intervention. It is the idea of the “greed” of the entrepreneur and the free market that is the unexcelled protector of the consumer. It is in the self-interest of every legal business to uphold product quality and to have a reputation for honesty and integrity. Alan Greenspan, argues that “ since the market value of a going business is measured by its money making potential, reputation or good will is a much as an asset as its physical plant and equipment”. The reputation of a company is a huge asset to any modern brand. The loss of reputation through the sale of *dangerous or shoddy* product will and must reduce the market value of said company. Reputation, in a free market is a powerful competitive tool. Government control does not always build in “minimum standards” or product quality; it is the efficiency of the free market that inevitably leads to high product quality. Thus, when this natural control is removed, such as in the case of prohibition, the consumer is has absolutely no means of protection. As neither the government will recognize the consumption of an illicit drug, and the profit motives are removed, as branding and reputation are virtually non existent in the underground economy. (Greenspan, 1967)

socially deviants and are more likely to engage in violent and other criminal behavior. Although in Canada, there is evidence that a large section of marijuana suppliers are non-violent and operate like any small to medium sized business¹⁴¹, there are still significant involvement of organized crime and the illicit drug trade. The evidence from previous studies, presents a robust positive relations between violence and prohibition, the standard defense of prohibition assumes that enforcement reduces violence, in stark contrast to the empirical results from examining alcohol prohibition in the early part of this decade. Additionally although the impact of organized crime and prohibition is measured by the homicide rate, the impacts of organized crime extend much farther than homicide rate. There has been a movement over time for organized crime to move into quasi-legal activities that promote corruption and crime well beyond street crime that is normally associated with organized crime. This extension of organized crime would only work to increase the negative impact of prohibition on organized crime, by allowing criminals to fund and promote more crime and violence. There is a concern that legalization of marijuana or other illicit drugs, may not significantly impact organized crime. There are two main reasons that legalization may not totally migrate the effects of organized crime. The first is that even with many legal goods such as alcohol and tobacco, illegal markets still exists for these goods, even though they can be obtained legally, for example native cigarettes which are sold illegally all across Canada. Therefore, without a social experiment or a law change, it may be possible that illegal black markets of drugs would exist, even in the absence of prohibition. The second main reason that may be problematic in the legalization of marijuana, is that there would still

¹⁴¹ Mulgrew, 2005

exists massive arbitrage opportunities for the exportation of marijuana to the US and other countries where the price of marijuana is relatively more expensive than Canadian grown marijuana. The opportunity for profit from exporting marijuana may, in the absence of prohibition, give ample incentive for a black market to remain in Canada. There is reason to believe that after the prohibition of marijuana Canada may need in the short run to increase enforcement on illicit activities by organized crime. In the 1920's the repeal of prohibition did not immediately put organized criminals out of business, as one would expect not to happen according to economic theory. In the years after prohibition, 'nest eggs' had amassed during prohibition and provided a foundation to expand into other illicit business ventures, including gambling, narcotics trafficking and labour racketeering.¹⁴² The results of the marijuana reform experience in the Netherlands do suggest that in the long run marijuana legalization should reduce the level of organized crime as predicated by economic theory. If marijuana were legalized our research indicates that there should be benefits to Canada in terms of a reduced level of organized crime and a reduction in resources spent fighting organized crime.

9. Benefit Cost Approach

This research has established that the common arguments against the legalization of marijuana do not exist. In the above sections this research has demonstrated that marijuana does not have any serious short or long term negative health impacts, that marijuana addiction is not a viable reason for marijuana criminality and bears no real

¹⁴² Liddick, 1999

costs, the Gateway Theory of drug sequences does not exist, there is no connection between marijuana and crime, that marijuana does not lead to violence and that prohibition is itself the major contributing factor in the rise and prominence of organized crime. The next part of this research will attempt to monetize the true benefits and costs of marijuana legalization.

The key figure of interest for any benefit cost analysis is the estimated total net value to society, expressed in terms of discounted present value. Given this, policymakers should pursue changes that maximize net societal benefits, that is, those for which the present value of societal benefits minus societal costs is greatest. This analysis will consider the perspective of three primary parties for gauging both benefits and costs. The relevant stakeholders in this benefit cost analysis are; those who consume or would consume marijuana, both the provincial and federal government and the Canadian society.

There are five areas of benefits that this report will monetize the savings to the police system, the savings to the court system, the savings to correctional facilities, the reduction in organized crime and the increase in consumer surplus.

The costs that are involved with the consumption of marijuana considered in this report are categorized into four areas the direct health care costs, the research and development costs, indirect damage costs and economic loss of income.

10. Economic Analysis

10.1 Equilibrium Price and Quantity

To date, prices of marijuana have not been analyzed in any particular detail in Canada. As a proxy to empirical and/or case studies on the pricing of marijuana in Canada, this report will use marijuana prices based on studies of price, street sources and police seizures in the United States, Canada and Australia. There are a number sources for marijuana prices; the prices cited by police in seizures, prices based on drug agency government reports, the federal government's System to Retrieve Information from Drug Enforcement (STRIDE) program, the National Survey on Drug Use and Health and academic studies on the economics of marijuana. The problem with the first two sources is that they are not always an accurate measure of an average price of marijuana; they are simply the highest and/or lowest price on the market, and therefore will not be considered by this analysis.¹⁴³ The other sources of marijuana price attempt to obtain an accurate average price paid by consumers of marijuana by empirical work. In order to get the most accurate price of marijuana paid by consumers, this report will use a number of different sources from the above list to find an “average” price paid by consumers. In order to analyze supply and demand, the study will consider prices in terms of grams, ie how much does the average consumer pay for one gram of marijuana. We created an average price for three geographical locations, based on a variety of different sources (see appendix Price). This approach to calculating prices is similar to the approach used in the

¹⁴³ Gettman, 2007

study by Desimone (2001) when calculating marijuana and cocaine demand and as Miron (2004) in his analysis of marijuana decriminalization.¹⁴⁴

The ‘average price’ was calculated and converted to real prices by dividing the price by the annual consumer price index for each geographical year as a whole, for the given year of the marijuana price (appendix - Price).

	USA	Canada	Australia
Average Price	\$13.69	\$9.07	\$11.60
Grand Mean	\$11.46		

After all prices were converted to 2001 dollars, the average price was determined to be \$13.69, \$9.07 and \$11.60 dollars per gram and for the United States, Canada and Australia respectively (see appendix - Price). The price used in this analysis will be the average of the three prices, 11.60. From analyzing price data from various sources and studies, this price appears to be a good approximation of current street prices of marijuana. The real price of marijuana has been steadily falling over the last 20 years and current anonymous street sources indicate that across Canada marijuana is now approximately \$10.00 per gram. The slightly higher price that we will be using accounts for the possible higher price several years ago, perhaps coinciding with harsher penalties for marijuana related crimes and a lower level of hydroponic technology.

There is also evidence that suggests that consumption patterns which display variation can be explained by differences in incomes and prices across countries. At a broad level, consumption is mostly driven by variations in observable economic variables

¹⁴⁴ Desimone, 2001

and that income and price elasticities for marijuana were not identical across countries. Clements and Zhao (2009) in their analysis of marijuana consumption patterns of Australians compared to the rest of the globe conclude that “Australians are (probably) not unique, and there is some basis for thinking that many of the earlier results on the operation of marijuana for marijuana and related products in Australia are probably applicable to other countries”¹⁴⁵. Therefore using data from other nations such as the US and Australia should give a reasonable estimate for possible in Canada.

The price data suggest that the United States might have slightly higher marijuana prices on average, than either Australia or Canada (which is also in line with various street sources). This is because generally the United States has much stricter laws regarding the use of marijuana and spends considerably more resources fighting drug crime. Thus, in theory, with these two factors considered, the price of marijuana in Canada should be relatively lower than the United States, given Canada’s more lax marijuana laws, making it easier and less costly to supply and distribute marijuana. The 11.6 dollars per gram is assumed to be the market clearing price for marijuana users.

The market clearing level of demand was derived by estimating the total number of users of marijuana, then we found the frequency of cannabis by percent of the total marijuana consuming market, from here we estimated the portion of marijuana users that fall under each of the types of “frequency users”. Given these estimates we applied a use factor for each of the frequencies to obtain annual consumption patterns. According the one Canadian report on consumption of marijuana, the average user smoked approximately 0.5 grams each time they consume marijuana, we then used the annual

¹⁴⁵ Clements and Zhao, 2009

frequency of consumption and factored in the level of consumption (0.5) grams to obtain the total gram consumption of all marijuana users in Canada. Finally we divided this number by the total number of marijuana users to find the equilibrium quantity in grams for each user of marijuana. The equilibrium quantity was estimated to be approximately 33.1785. The results of our equilibrium quantity analysis are highlighted in the follow tables of this section:

Population of Canada	32,576,100.00
% of Population who Consumes	0.168
Total Users	5,472,785

Frequency of cannabis use in past year					
	Male	Female	Total	Total as %	5,472,785
Among current users:					Current Users
Less than once a month	41.3	57.5	47.3	0.473	2,588,627
1 to 3 times a month	18.2	17.6	18	0.18	985,101
Once a week	11.3	7.1	9.7	0.097	530,860
More than once a week	18.2	0.3	15.3	0.153	837,336
Every day	11.1	7.4	9.7	0.097	530,860

Among current users:	Total Users	use factor	User by Frequency	Consumption in Grams
Less than once a month	5472784.8	12	31063526.52	15531763.26
1 to 3 times a month	5472784.8	24	23642430.34	11821215.17
Once a week	5472784.8	52	27604726.53	13802363.27
More than once a week	5472784.8	104	87082951.74	43541475.87
Every day	5472784.8	365	193763945.8	96881972.92
total				181578790.5

Equilibrium Grams	33.1785
Consumed per Capita	

10.2 Elasticity of Demand

It has previously been determined that the price of marijuana is a significant determinant of marijuana consumption.¹⁴⁶ In order to derive a demand curve and assess the impacts of changes in marijuana laws, the elasticity of demand with respect to price must be estimated. Marijuana has been found by a number of economists to be price inelastic; most of the empirical work that has attempted to estimate the elasticity of marijuana has found significant robust results that indicate the elasticity is less than zero¹⁴⁷. Due to constraints to replicate these studies and calculate elasticity for Canada would be far too tedious and outside the scope of this research study, for the purposes of this study, data from several secondary sources is used to estimate a price elasticity of marijuana. Data was gathered from several previous studies and their price elasticities are summarized in the below tables

Price elasticity of demand for Marijuana			
Daryl, 1999			
Type of consumer	Male	SE	
Daily User	-.33*		-0.16
Weekly User	-.40*		-0.11
Monthly User	-.44*		-0.12
Occasional User	-.16*		-0.07
No longer a user	0.05		-0.06
All Users	-.26*		-0.08
Non-users	-0.01		-0.01
All types	-.16*		-0.05
	Female	SE	

¹⁴⁶ Daryl, 1999

¹⁴⁷ Daryl, 1999

Daily User	-0.5	-0.53
Weekly User	-.51*	-0.1
Monthly User	-.35*	-0.11
Occasional User	-.08*	-0.04
No longer a user	-0.01	-0.01
All Users	-.25*	-0.07
Non-users	-0.01	-0.02
All types	-.12*	-0.04
	All	SE
Daily User	-.34*	-0.15
Weekly User	-.44*	-0.08
Monthly User	-.39*	-0.08
Occasional User	-.12*	-0.04
No longer a user	0.02	-0.04
All Users	-.26*	-0.05
Non-users	-0.01	-0.01
All types	-.14*	-0.03
* indicates significance at 5 percent level		

Price elasticity of demand for Marijuana		
Nisbet and Vakil, (1972)		
Type of Data	Demand Model	
	double log	linear
Market Survey	-0.37 (0.06)	-0.51 (0.04)
Actual Purchase	-1.01*(0.3)	-1.51 (0.31)

Price elasticity of demand for Marijuana	
Study	Elasticity
Pacula, (2000)	Estimated For Youth
	-0.33
Miron, (2005)	Review of other Studies
	-0.5

Upon analysis of these elasticities calculated by these studies the average tends to cluster around minus one half. Clemments and Zhao (2009) argue that this 'centre of

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gravity' value of minus one half applies in a number of other instances and they provide some empirical and theoretical justification behind the regularity of price elasticities of being equal to minus one half. The results of their analysis are summarized as follows: the price elasticities for beer, wine, spirits and marijuana tend to be clustered around the value of minus one half (based on the idea of preference independence), other studies not based on preference independence also find values of minus one half for price elasticities and they argue that when little or nothing is known about the price sensitivity of a good, a reasonable value of its price elasticity is about minus one half¹⁴⁸. This report will use the value of minus one half to estimate consumer demand and evaluate potential changes to equilibrium price and quantity.

10.3 Elasticity of Supply

To date virtually no work has been done examining the slope of the supply curve for Marijuana, presumably due to a lack of reliable data, given the illegal nature of the good. However, it is possible to infer basic information on the slope of the supply curve by understanding how shifts in the demand for marijuana influence the equilibrium level of prices observed in the market. In one study on the impact of changing user sanctions (decriminalization) on prices, found how economic variables influence user and seller risk which can be used to make some theoretical assumptions about supply. The authors argued that if the supply of marijuana is perfectly competitive or one presumes a

¹⁴⁸ Clemments and Zhao, 2009

relatively short run adjustment period, then it is appropriate to think of the supply function as infinitely elastic.

If ones consider the economic factors which determine the elascity of supply and compare these characteristics to a legal product (such as tobacco) one should be able to infer the basic elements of marijuana supply. If we use an agricultural farm supply curve and elascity studies as a proxy for the elascity of supply of marijuana we can derive an estimated supply response function for Canadian marijuana suppliers. If we assume that marijuana has similar availability of raw materials and a similar length and complexity of production time, as similar agricultural farm products (tobacco, tomatoes, strawberries etc). Marijuana as a crop is very similar to tobacco, they both require similar levels of agricultural inputs and labour to grow and process, the production factors that determine cost function of tobacco should be almost identical to those of marijuana. The only discernable difference would be if marijuana were more costly to produce because of the risk premium or less costly because of black markets avoiding government regulations.

Estimates predict that the elascity of supply of agricultural products generally centers on a positive value of 1. Crop-specific acreage elasticities range between zero and 0.8 in the short run while long-run elasticities tend to be higher-between 0.3 and 1.2, for agricultural farm products.¹⁴⁹ Estimates of supply elasticity obtained from profit function studies differ considerably across countries: 0.35 for China, 0.42 for Malaysia, 0.52 for Turkey, 0.90 for Thailand and 0.98 for Japan.¹⁵⁰ However the differences in supply functions across countries can easily be explained by differences in the determinants of supply elascities, which include technological factors, economic factors, and the relative

¹⁴⁹ Rao, 1989

¹⁵⁰ Ibid

importance of the crop, farm incomes and farm size and sociological dimensions. The more developed countries exhibit supply functions closer to 1. Long-run aggregate agricultural supply elasticities obtained from conventional supply functions fitted to time series data tend to be relatively inelastic in the range of 0.1 to 0.4. Elasticities of agricultural farm goods of input demand studies have generally been greater than 1.¹⁵¹ The evidence from studies on the elasticity of supply for agricultural farm products seems to hover around the value of one for developed nations. This report will use the value of 1 as the estimated value of the elasticity of supply of marijuana and this value will be used to estimate the effect of a policy change on the supply function for marijuana.

10.4 Impact of Legalization on Supply

A prohibition is a legislative act which forbids the production, exchange and sale of a product or service. Why prohibit something? The purpose of the prohibition is to interfere with a working market to ideally curtail the production, exchange and consumption of a good with the ultimate goal of completely eliminating it from society. Behind this framework a third party (government) needs to set up a system to prevent people from consuming a good or service, so a system of enforcement and punishment will need to be created to discourage activity in the marketplace. In theory the allocation of resources to preventing the use of a particular good is directly related to the risks associated with that good and thus will impact decisions to consume, sell or produce the illicit substance. Prohibition is both a supply and demand side policy. The idea behind

¹⁵¹ Peterson, 1988

prohibition laws is to increase the opportunity costs for any party involved in the consumption of an illicit substance.

In general most economists agree that marijuana legalization should reduce the cost of production and supply should increase (see appendix – Effects of Legalization on supply and demand for all possible economic effects of legalization). The risk premium for marijuana represents the costs that producers have to incur to avoid prosecution; these costs are over and above the basic production costs. These risk premium costs would not be incurred in a legalized regime. These costs might include cost of security, bribes and protection. If marijuana were legalized and prices were left up to the market to be determined, with no government control or regulation one would expect the prices to fall by the amount of the risk premium. Clements, Land and Zhao (2010), analyze the marijuana risk premium by assessing three sources of means of calculating the risk premium associated with the production of marijuana. They analyze the tobacco market, legal and illegal markets and a decomposition of drug production costs to estimate the risk premium associated with marijuana. They looked at the difference in costs of production and profit margins between tobacco products and marijuana markets to estimate the value of the risk premium captured in the significantly higher price per gram of marijuana over tobacco. They also did a similar study on a number of different goods and services in legal and illegal markets to estimate a general risk premium. Finally they decomposed the drug production value chain to attempt to categorize and evaluate each of the costs to estimate a potential risk premium for marijuana. The numerical value of the risk premium is a key parameter for estimating the possible effects of legalization on prices. Although Clements et al, (2010) conclude that they are not able to make a definite

estimate of the risk premium based on their analyses of sources; they would favor a premium in the range of 200 – 300 percent. They estimate from their research a function which can give estimates of the risk premium given below:

Consumer price of marijuana (p_1)

Production costs (p'_1)

Risk premium Ω is $p_1 = (1 + \Omega) p'_1$.

The possible change in supply however will be dependent on the level of government involvement in the marijuana market. If the market for marijuana is left to the forces of the marketplace it would be easy to estimate the effects of supply and demand. Since in a legalized market the government is able to levy taxes and or subsidies, from a policy makers perspective there is a wide range of possible effects of the supply side for marijuana, assuming that risk premium can be estimated with certainty. Then in theory the government could control the supply of marijuana by setting a tax rate in accordance with the risk premium. If the tax on marijuana were equal to the risk premium, then there would be no change in supply. If the tax were to exceed the risk premium, then consumer price would actually increase, as the cost of production under legalization would actually increase. If the tax rate were less than the risk premium, then the consumer price would decrease.

Although there is reason to believe that under legalization, it is possible that the cost of production is lower in a black market than in a legal market (see appendix supply curve for detailed explanation). This report after careful consideration of the empirical work done on decriminalization and theoretical underpinnings of prohibition it seems more likely that the costs of production should fall in a legalized market. The degree of this shift however would be dependent on a number of variables, which cannot be

estimated with complete accuracy. This report used several potential changes in supply to estimate what the costs and benefits would be under various potential changes. This report estimated benefits and costs based on the supply curve shifting upwards and downwards by 5%, 10%, 20%, 50% and 100%, these changes in supply are summarized in Appendix - Surplus. In order to then assess the impact on supply this report created a supply function based the general formula for arc elasticity, equilibrium values for price and quantity and the estimated elasticity of supply. Based on this supply function we recreated 5 new supply functions based on the 10 potential shifts in supply (upwards and downwards by 5%, 10%, 20%, 50% and 100%). Summarized below are the results of the estimates for the supply function and the changes that result from the consumption changes due to the legalization of marijuana.

Original Supply and Demand			
qs = 2.86		Equilibrium P	11.6
qd = (33.17p + 1154.49)/(3p + 11.6)		Equilibrium Q	33.175

supply shifts up			
% change in Qs	new qs	new ps	new qs function
1.05	34.83375	10.5201	q=3.31p
1.1	36.4925	9.58	q=3.81p
1.2	39.81	8.032	q=4.96p
1.5	49.7625	4.9712	q=10.01p
2	66.35	2.3199	q = 28.59913793p

supply shifts down			
% change in Qs	new qs	new ps	new qs function
0.05	31.51625	12.849943	q=2.4526379111p
0.1	29.8575	14.325722	q=2.0841884387p
0.2	26.54	18.2266093	q= 1.4561127933p
0.5	16.5875	57.9825222	q = 0.2860776959p
1	0	0	0

These estimates for possible changes in the level of supply will be used throughout the rest of the benefit cost analysis to determine the incremental costs and benefits.

10.5 Impact of Legalization on Demand

Since there has never been a case of marijuana legalization, there is no empirical work measuring the effects of the impact of legalization on demand for marijuana. In order to assess the impact of legalization on demand, there are two sources that can guide us in estimating the potential effects of marijuana legalization. The first sets of sources

are studies of the impact of decriminalization on marijuana demand; decriminalization studies and demand theory.

Decriminalization is the abolition of criminal penalties in relation to certain acts, whereas legalization is the process of removing a legal prohibition against something, which is currently not legal. Although these two policies are different, they are similar enough that we can use the effects of decriminalization as a proxy to what might happen if marijuana were legalized. In a recent review of the experience of marijuana decriminalization among 11 US states, detailing the effects of reduced criminal sanctions for marijuana crimes. The study concluded that although it is impossible to uniquely identify the decriminalized states based solely on criminal penalties, the association between decriminalization and increased use is robust.¹⁵² Another study of the effect of changing user sanctions on consumption patterns found that both the decision to participate is responsive to price changes - such that the reduction in user sanctions and a prevailing price reduction would increase marijuana consumption by youth.¹⁵³ The also found that decriminalization is associated with increases in the prevalence of marijuana consumption by males over the age of 25.¹⁵⁴ In analyzing demand for illicit drugs, one study found that marijuana decriminalization increases the probability of marijuana participation by about 8%. Another study which examined the effect of opium decriminalization in China and found little evidence that legalization increased exports or decreased price. Thus, the evidence suggests China's opium prohibition had a minimal

¹⁵² Pacula, 2003

¹⁵³ Williams, 2003

¹⁵⁴ Williams, 2003

impact on opium consumption¹⁵⁵. The past work on the effect of decriminalization on the consumption of marijuana indicates that reductions in user sanctions result in increases in consumption of marijuana.

Recent work by Clements and Zhao (2009) used a zero inflated ordered model of mapping marijuana consumption, in order to isolate the effect of those who do not smoke marijuana for personal reasons and those who do not smoke marijuana for legal reasons and found that decriminalization had effects on both participation and consumption choices of Australians. In another study by the same authors that analyzed consumption patterns in several Australian states, looked at deviations from state trends for states that decriminalized marijuana in Australia. They found sharp participation spikes for states that decriminalized marijuana around the time of marijuana decriminalization. They found that participation in marijuana use in the Australian Capital Territory after decriminalization increased by approximately 6 percent. The below table, summarizes the studies on decriminalization of marijuana in Australia. The majority of studies on the effects of decriminalization on consumption patterns generally all come to the conclusion that with lower user sanctions there is an increased consumption of marijuana (upward shift in demand).

¹⁵⁵ Miron, 2005

Authors	Year	Marginal Effect	Variable	Data	Econometric Model
Donnelly et al	1995	Insignificant	lifetime and weekly use	NDSHS 85 -93	Logistic regression (control age and gender)
Donnelly et al	1999	Insignificant	in lifetime and weekly use	NDSHS 85 -95	Logistic regression (control age and gender)
Cameron and Williams	2001	2%	12-Month Use	NDSHS 85 -95	Probit
Williams and Mahmoudi	2004	1.10%	12-Month Use	NDSHS 88 -98	Probit
Zhao and Harris	2004	1) 2% 2) 2% 4%	12-Month Use conditional given participation Weekly Monthly	NDSHS 95 - 01	Multivariate Probit Probit and OP
Williams	2004	1) Insignificant 2) 5% 3) Insignificant	12 month full sample 12 month males over 25 conditional given participation	NDSHS 88 -98	Probit and OP
Clements and Daryal	2005	1) 4% 2) 8%	% change in consumption quantity current users whole sample	UWA first year students 1998	Descriptive Stats
Ramful	2008	Insignificant	12 month use	NDSHS 98 -04	Probit
Damrongplasit et al	forthcoming	1) 3.7% 2) 4% 3) 13.7% 4) 16.2% -18.2% 5) 5.9% - 11.2%	12 month use	NDSHS 01	Probit Bivariate Probit 2 Part Probit Probit Switching Propensity Score

Demand theory indicates that the main determinants of demand are income (I), the price of the good or service (P1), the prices of other goods (P0), and other variables (β) such that the demand for a good would take the following form:¹⁵⁶

$$q = q(I, P_1, P_0, \beta).$$

However, given the illicit nature of marijuana consumption, it also involves risks of fines, incarceration and other costs which also affect the demand for marijuana. These costs are the risk premium for consuming marijuana (P_m). For the purpose of this analysis, P_m includes the costs of fines, potential criminal charges, the possibility of incarceration and the social stigma associated with drug use. These additional costs of consumption increase the total cost of consuming marijuana beyond the price of purchasing the good and in theory should lower the demand for marijuana. If costs of consuming a product increase, people will be less likely to consume that goods. If these costs are included in demand, the full cost of marijuana consumption could be obtained, and marijuana demand would take the following form¹⁵⁷:

$$q = q(I, P_1, P_0, P_m, \beta).$$

¹⁵⁶ Daryal, 1999

¹⁵⁷ Daryal, 1999

Both legalization and decriminalization should eliminate most of the costs associated with marijuana consumption, thus the cost P_m would fall, and hence the full price of marijuana consumption falls, and it could be predicted that the demand schedule for marijuana should rise after the legalization or decriminalization of marijuana.¹⁵⁸ Likely the increase in marijuana consumption would be small, but significant, none the less.. The majority of the increase in demand would come from those who were previously discouraged to consume marijuana because of the risk premium (P_m) associated with consumption and those who would purchase more, as a result of the decrease in price.

Under legalization the demand schedule should increase and the full costs of using marijuana would also fall. If legalized however, it is possible for the government to either control or regulate the supply of marijuana. Consuming marijuana has a number of negative effects and social stigma; it is likely that the government would not want rampant increased consumption of marijuana. If we assume that the government would want to reduce consumption, one way of doing so would be to restrict supply either by taxing producers or controlling supply directly. The restriction of supply is what keeps prices higher than otherwise the free market would allow.

This research based on the empirical estimates of the changes in demand due to the reductions in users sanctions in states of marijuana decriminalization calculated shifts in consumption by 2%, 4%, 8%, 10% and 15%. We derived an equilibrium quantity of marijuana consumed by estimating total demand for marijuana and finding the equilibrium amount of marijuana consumed in grams. The below table gives the estimated demand curve (based on arc elasticity, the equilibrium price and equilibrium

¹⁵⁸ Ibid

quantity of marijuana) and the various potential shifts in the demand schedule and the resulting new demand curves.

Original Supply and Demand					
$q_s = 2.86$			Equilibrium P	11.6	
$q_d = (33.17p + 1154.49)/(3p + 11.6)$			Equilibrium Q	33.175	
% change in Q_d	New Q_d	New P	New Q_d Function		
1.02	33.8385	11.8316434	$q = (33.83p + 1201.0)/(3p + 11.83)$		
1.04	34.502	12.0636364	$q = (34.50p + 1248.65)/(3p + 12.06)$		
1.08	35.829	12.5276224	$q = (35.82p + 1346.57)/(3p + 12.52)$		
1.1	36.4925	12.7596154	$q = (36.49p + 1396.88)/(3p + 12.75)$		
1.15	38.15125	13.3395979	$q = (38.15p + 1523.76)/(3p + 13.33)$		

Under legalization the costs of using marijuana will decrease more so then under decriminalization. For example, there may be even less stigma associated with smoking marijuana from persons who only considered marijuana as ‘bad’ because it was criminal in the past. As well there would be other factors such as the increase in safety when purchasing and possible increases in the quality and consistency of product. The exact shift in consumer demand however is impossible to accurately predict. This report will calculate changes in benefits and costs based on the above 5 potential changes in consumer demand.

11. Benefits

If marijuana laws were changed there would be several both quantifiable and unquantifiable benefits. If marijuana were legalized a huge benefit would be the savings in terms of resources for our justice system. Federal, provincial and municipal governments are all involved in upholding Canada's justice system, each of these level of government would save money, as they would not have to investigate, persecute, punish and process marijuana related crime. There would be a reduction in police resources resulting in fewer arrests, reduction in correctional service costs and the reduction in prosecution and judicial resource from marijuana court cases. To estimate the savings in criminal justice resource, this report uses the methodology set out by previous studies that estimated potential savings from marijuana law reform.

The methodology used by previous studies, estimated benefits and costs by calculating the proportion of total resources spent in each benefit or cost area for marijuana. This proportion will be applied to the corresponding level of expenditures in order to get an estimate of costs and/or benefits associated with marijuana prohibition.

In many studies of estimates for cost savings with respect to marijuana crime, the studies use the same methodology that is being used by this report. This methodology has been criticized, arguing that the primary problem with this methodology is that although they accurately represent the proportionate level of costs and benefits, they are not useful in estimating the savings to the criminal justice system, and many other government agencies. It has been argued that because it is a simple and static cost-benefit model, it fails to recognize that government agencies budgets are relatively fixed and operate

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independent of the level of activities or events (such as arrests or court time) reported by that particular agency, and thus that cost savings are highly exaggerated.¹⁵⁹

However, knowing this information, this report will still use this methodology. A benefit cost analysis must consider all economic costs; judicial resources spent on marijuana represent an opportunity cost for government and must be considered. The ‘savings’ are not in terms of actually how much money the government would save, but the opportunity cost; these agencies could refocus their time, energy and ‘savings’ on other more important aspects of society. Many of these agencies, such as the criminal justice system, are overburdened already and must make decisions often not on fairness, justice or societies’ interest, but also based on resource management. The potential ‘savings’ from either legalization or decriminalization, could be considered as a source of relaxation on the burden on our system, and will have ripple effects across the economy and government. Therefore, this analysis will still consider the previous methodology of estimated ‘savings’ as correct, and will use this estimate procedure given the criticisms. For each of the benefits, cost savings were considered for legalization was for possession related offences, including possession, trafficking, importing and production. Although it would be still possible that people may be prosecuted for trafficking, importing and production, it is assumed that in a legalized regime there would be no need for consumers to obtain marijuana from black market sources and these marijuana related crimes would fall close to zero. Finally this report will assess consumer and surplus changes as a result of the marijuana reform and the reduction in the level of organized crime. These two

¹⁵⁹ Austin, 2005

types of benefits have not been assessed in previous studies on the benefits of marijuana legalization.

11.1 Police Savings

The first benefit that was considered was the reduction in police resources spent on marijuana arrests, investigations and all other policing related activities. If marijuana were to be either decriminalized or legalized the police force would have to spend less money on enforcing drug laws in Canada. In order to estimate police savings, data was gathered from Statistics Canada, for all incidents of marijuana crimes, total crimes and total police expenditures. It was assumed that police resources are allocated in a manner which is in proportion to how much a crime accounts for the total of all crimes committed. In order to estimate police savings, data was gathered from Statistics Canada, for all incidents of marijuana crimes, total crimes and total police expenditures. The data that was obtained was based on the number of incidents, not the number of convictions, assuming that costs would be relatively the same for incidents, charges and convictions. The savings or benefits if marijuana laws were changed were calculated by obtaining the proportion of marijuana crimes which could be attributed to all crimes, and multiplying this percent by the total police expenditures in each respective year from 1986 until 2007 to obtain, the total resources spent on both possession and all marijuana crimes.

	Expenditures on Marijuana	Per Capita Spending
1986	\$58,931,414.03	\$2.26
1987	\$62,413,176.09	\$2.36
1988	\$62,745,417.38	\$2.34
1989	\$65,750,495.21	\$2.41
1990	\$66,738,559.20	\$2.41
1991	\$52,713,055.10	\$1.88
1992	\$57,786,194.30	\$2.04
1993	\$63,264,934.85	\$2.21
1994	\$73,075,461.43	\$2.52
1995	\$78,587,439.62	\$2.68
1996	\$85,000,031.30	\$2.87
1997	\$88,636,438.40	\$2.96
1998	\$100,137,647.76	\$3.32
1999	\$126,609,630.36	\$4.16
2000	\$151,306,318.86	\$4.93
2001	\$166,256,555.95	\$5.36
2002	\$184,870,658.10	\$5.89
2003	\$161,850,463.37	\$5.11
2004	\$194,652,008.14	\$6.08
2005	\$190,505,918.31	\$5.90
2006	\$200,698,891.60	\$6.15
2007	\$233,257,616.42	\$7.07

Average	\$114,808,560.26	\$3.77
Max	\$233,257,616.42	\$7.07
Min	\$52,713,055.10	\$1.88

The above data was regressed using OLS to determine if there was a relationship between time and increased spending. This report found that there have been disproportional increases in the level of spending on marijuana crime and therefore used the last year of expenditures as the most appropriate level of spending. In 2007 233

million dollars were allocated to fighting marijuana crimes by police in Canada, this value was converted into 239 million 2009 dollars. If marijuana were legalized the 239 million dollars could be reallocated to the benefit of the police force and all Canadian citizens who would benefit from the reallocation of resource to prevent and reduce other crime. The economic benefit from marijuana legalization in terms of police savings is 239 million dollars.

11.2 Court Savings

The second main cost of marijuana prohibition is the portion of the prosecutorial and judicial budget devoted to marijuana prosecutions. If marijuana were legalized the Ontario court system would not have to handle as many marijuana crime related cases. If marijuana were decriminalized then possession related court costs would fall to zero and there would be a reduction in cases handled by the courts for other marijuana related crimes. If marijuana were legalized, the court would not have to deal with almost any of the current marijuana related offenses and would save significant resources and time. To calculate court savings, data from Justice Canada on total spending on courts, legal aid plans and prosecutions was obtained for Canada Data was used from 2000, since older data was not available. Also because there was no older data, the fraction of marijuana crimes of all crimes could not be applied on a year by year basis. In 2000 it was calculated that marijuana crimes made up 2.72 percent of all crimes, and this value was

applied to the expenditures on the court system. The full costs are listed in the below table

Per Capita Spending Marijuana and Justice System (1000's)					
Year	Courts	Legal Aid	Prosecutions	Youth Corrections	Total
1994	\$366,410	\$277,966	\$113,713	\$227,427	\$1,806,779
1995	\$392,355	\$284,119	\$121,765	\$230,001	\$1,907,657
1996	\$420,932	\$261,268	\$130,634	\$246,753	\$2,017,571
1997	\$443,995	\$221,997	\$133,198	\$251,597	\$2,071,975
1998	\$516,027	\$258,014	\$145,133	\$258,014	\$2,354,375
1999	\$653,303	\$316,753	\$197,970	\$336,550	\$3,048,745
2000	\$756,695	\$378,348	\$244,813	\$378,348	\$3,538,662
Total Spending Marijuana and Justice System(1000's)					
1994	\$10,587,980	\$8,162,095	\$3,247,149	\$6,645,916	\$52,573,492
1995	\$11,473,000	\$8,415,337	\$3,531,195	\$6,872,976	\$56,255,583
1996	\$12,468,296	\$7,779,984	\$3,846,448	\$7,446,142	\$60,120,701
1997	\$13,423,435	\$6,733,917	\$4,010,751	\$7,385,109	\$62,292,436
1998	\$15,400,195	\$7,966,174	\$4,482,989	\$8,030,678	\$71,356,925
1999	\$19,737,655	\$9,641,161	\$6,077,693	\$10,056,899	\$92,333,421
2000	\$23,123,711	\$11,394,937	\$7,455,672	\$11,305,914	\$107,895,814
				Average	\$71,832,625

The annual expenditures on marijuana related crime is related to the expenditures on police activities to capture people committing these crimes. Similar to the police expenditures this report assumes that these expenditures would follow a similar increasing pattern to that of total police spending and the value of expenditures for the year 2000 was converted into 2009 dollars to keep consistent with the rest of this analysis. In 2009 dollars the total savings to the court system, legal aid plans, and prosecution spending and youth corrections is 108 million dollars. The total economic

benefit from savings to the court systems with marijuana legalization is 108 million dollars.

11.3 Prison Savings

The third main cost of marijuana prohibition is the portion of the corrections budget devoted to incarcerating individuals charged with marijuana related offences. If marijuana laws were changed, people who currently are sentenced for marijuana crimes would not have to be under the care of the justice system. Furthermore, there would be no future incarceration of prisoners or any other type of sentences for possession. For possession offences the mean prison length was 17 days, the mean probation length was 257 days. For trafficking offences the mean prison sentence was 241 days and the mean probation time was 373 days. Data for production and importation was not available so the benefits were not calculated. The total number of those incarcerated and on probation was gathered from statistics Canada. The total time spent in prison and on probation was calculated using the total number of offenders and the average time spent being processed in the Canadian justice system. The average daily inmate cost and average daily cost of probation we gathered for each year and was applied on a year by year basis to the total time marijuana criminals spent in prison and on probation to find the total spending on marijuana in terms of incarceration. The below table summarizes the total savings by year, from 1994 until 2000 for both prison and probation costs for possession and trafficking marijuana crimes.

	Prison Savings	
Year	Possession	Trafficking
1994	\$70,639,183.38	\$102,513,033.37
1995	\$77,303,572.43	\$91,700,596.20
1996	\$90,157,371.77	\$110,842,812.07
1997	\$96,932,965.08	\$115,926,822.78
1998	\$103,732,869.42	\$118,492,744.63
1999	\$114,250,524.21	\$158,417,647.47
2000	\$128,448,122.82	\$163,309,722.62
2001	\$118,345,427.77	\$124,876,949.99
2002	\$148,925,360.40	\$128,558,143.54
2003	\$106,079,843.83	\$146,326,666.81

	Probation Savings	
	Possession	Trafficking
1994	\$24,003,687.12	\$7,483,951.92
1995	\$25,703,774.32	\$7,170,850.06
1996	\$26,459,109.41	\$6,717,023.54
1997	\$25,207,254.70	\$5,553,316.54
1998	\$27,931,905.69	\$5,199,623.73
1999	\$31,598,925.19	\$6,006,224.12
2000	\$37,949,451.56	\$6,172,982.12
2001	\$41,736,421.23	\$6,175,634.23
2002	\$45,621,791.34	\$6,456,938.73
2003	\$40,454,381.83	\$7,575,135.80

The total resources spent on the justice system in 2003 were approximately 300 million dollars. This figure was converted to 2009 dollars to be consistent with the rest of the data; in today's dollars the total resources spend on the justice system is approximately 301 million dollars. If marijuana were legalized these resources could be freed up as those in prison for marijuana related crime could be released and those on probation would not need to be monitored. The economic benefit in terms of the resources saved in the Canadian justice system are approximately 301 million dollars.

11.4 Organized Crime

Another important benefit is that the legalization of marijuana would reduce the prevalence of organized crime and will have ripple effect on other sources of criminal activity. It has been argued that the prohibition of marijuana has similar effects on organized crime rates: “the parallel of Alcohol Prohibition causing more serious crime and prohibition of drugs causing more serious crime is an obvious case of history repeating itself”¹⁶⁰. Given the current laws, one of the major benefits that would result from the change in marijuana laws would be the reduction in organized crime and the harms resulting from the presence of a black market for marijuana supply. This research in a previous section established the link between organized crime and marijuana. Although legalization of marijuana would not eliminate organized crime in the short run, marijuana makes up a considerable fraction of organized crimes profits and legalization should move profits from black markets to regulated markets. One possible effect is that either private individuals or government could become suppliers of marijuana and eliminate the need for organized criminals to provide marijuana. If organized criminals lose a source of income this would have ripple effects on their ability to pursue other areas of crime and would reduce their overall power and presence in Canada. Second it is very possible that many criminals would simply legalize their current operations and continue to filter money into other branches of illegal activity. With this in mind it would be much easier for our enforcement authorities to fight organized crime and reduce their

¹⁶⁰ Miron, 2004

presence in power. In Canada, with its combined social, economic and violence generating effects, the illicit drug trade imposes the greatest burden on Canada of all organized crime activities. The economic exact cost of the illicit drug trade in Canada has been estimated but this information is censored and not available for public use. As a proxy to the economic impact of organized crime, this report will use the proceeds from crime as a best conservative estimate of the value of the organized crime market. These proceeds represent an estimate of incomes that organized criminals earn and can serve as an estimate of the potential change in the size and impact of the criminal market if marijuana were legalized. This estimate underestimates the actual economic and socio-economic impact that would benefit the Canadian public, as it does not account for any of the ripple effects from the proceeds from organized crime or any of the longer-term impacts on Canadian society and the economy.

Money laundering is the tactical imperative used by cash intensive criminals to integrate black market cash into legitimate business operations. What is known about the proceeds from crime empirically is derived from police cases that are defined by the RCMP as “proceeds of crime cases”. Of the 149 proceeds from crime cases, 111 cases involved a designated drug offence and of this total 60 (54 percent) involved marijuana.¹⁶¹

Given that marijuana makes up for a large portion of black market activity¹⁶², if marijuana were legalized we should see a massive fall in the profits of criminal organizations and a fall in their power and negative impact on Canadian society. Using

¹⁶¹ Margaret and Stephen, 200

¹⁶² Porteous, 2005

the value of money laundry as a proxy for profits. In Canada, the RCMP estimates that the drug trade has the ability to reach more than US\$3 billion at the wholesale level, which about percent is laundered through our monetary system¹⁶³. Applying a rate for marijuana crimes (54 percent) and a value for the amount of money that is processed in our system the estimate for black market profits on marijuana in Canada is about 1.13 billion dollars in potential reduction in profits and potential benefits. The economic benefit from a reduction in organized crime due to marijuana legalization is approximately 1.13 billion dollars.

11.5 Surplus

The final benefit that would result from the legalization of marijuana is the increase in economic surplus. The supply and demand of marijuana will change, causing a reduction in price and an increase in consumer surplus. This will benefit two groups of people; consumers: who were already purchasing marijuana at the initial market determined price and new consumers, who were unwilling to buy marijuana at the initial market price, but will now buy marijuana and the new price and will also receive some consumer surplus¹⁶⁴. The demand and supply curves for marijuana was estimated by deriving an initial equilibrium price and quantity based on Canadian consumption patterns. In turn each of these curves was analyzed according to five upward shifts in the demand schedule, five downwards shifts in the supply schedule and five upwards shifts in supply. The shifts were based on the empirical and theoretical research on the effects of

¹⁶³ RCMP, 2007

¹⁶⁴ Maslove, 2008

the legalization of marijuana. These equilibrium values were used to calculate demand and supply functions, in which then shifts were considered for a variety of possible economic changes. The results of this analysis and the changes in economic surplus are highlighted in appendix - Surplus. Estimated increase of consumer surplus under legalization depends on the possible shifts in consumer demand and supply (also if the government levies taxes or subsidies). It should be noted that in almost all possible changes in supply and demand lead to a net increases in consumer surplus.

12. Costs

The costs associated with marijuana consumption fall into four main categories; direct health care costs, research and development costs, indirect damage cost and the economic loss of income. Our data was extracted from the report *The Costs of Substance Abuse in Canada 2000*. This report provided estimates on the cost of illicit drug use in Canada. Since the report did not break down substance costs by type of drug for every cost considered, the fraction of marijuana consumption of total drug consumption was calculated and applied to obtain the total costs attributed to marijuana in Canada for each of the substance abuse costs. This report assumed that each drug type causes the same level of damage and therefore costs. Since the data that was collected was for costs of all drug types, marijuana costs should be isolated for a better estimate of costs. Among current drug users (people who had used any type of illicit drugs in the past year) 81.2

percent had used cannabis only¹⁶⁵. This was factored into the cost to get a better estimate of substance abuse costs. For each of the costs below, only the incremental costs were used in the benefit cost analysis, as any change in policy would only change costs by the marginal change in consumption and therefore marginal change in costs from substance abuse.

The incremental costs and benefits are dependant on the shifts in supply and demand. For example, if there are more people consuming marijuana there will be more traffic accidents if people consume marijuana and drive. This increase in costs will be directly dependant on how many more people are consuming marijuana. This report assumed that these costs functions exhibit constant returns to scale, such that if marijuana consumption increased tenfold then there would be a tenfold increase in the level of costs (benefits). For each of the costs associated with marijuana use from each of the above sections, the total costs that were calculated were converted into today's dollars and then depending on the percentage increase in consumption the incremental costs were increased by the same percentage increase in consumption.

12.1 Direct health Care Costs

It is generally accepted that smoking of any sort has a number of detrimental effects on the health of a human being (see the section on acute and chronic physical and psychological effects of marijuana). With the negative effects on the human body smoking marijuana leads to a number of direct health care costs imposed on our system.

¹⁶⁵ Tjepkema, 2004

The direct health care costs include the cost of morbidity, patient treatment, ambulatory care, family physicians and prescription drugs. If marijuana were legalized and consumption increased, there would be an increase in direct health care costs, as more people would suffer from the negative health effects from smoking marijuana. The increased incremental costs depend on the change in consumption, which depend on the shifts in the supply and demand curves, for a complete breakdown of all of the costs see the below tables.

Costs of acute care hospitalizations attributable to Marijuana, 2002		
	Cannabis	Illegal Drugs
Canada	\$71,569,374	\$426,368,141

Costs of psychiatric hospitalizations attributable to Marijuana, 2002		
	Cannabis	Illegal Drugs
Canada	\$1,451,105	\$11,537,966

Costs of inpatient specialized treatment attributable to Marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs
Canada	\$59,110,250.89	\$352,144,030

Costs of outpatient specialized treatment attributable to Marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs
Canada	9,451,192.41	\$56,304,633

Costs of ambulatory care services (physician fees) attributable to Marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs
Canada	\$3,801,542.63	\$22,647,350

Costs of family physician visits attributable to marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs*

Canada	\$8,191,892.92	\$48,802,469
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Costs of prescribed drugs attributable to marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs*
Canada	\$36,384,533.27	\$216,757,601

Number of ambulatory care services attributable to marijuana, 2002		
	Cannabis (estimate)	Illegal Drugs*
Canada	\$379,359.45	\$2260000

Total	\$190,339,250.57
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Depending on the level of change it is possible to see both an increase and decrease in costs, for a complete breakdown of each of the possible changes in cost due to the various shifts in the supply and demand curves see appendix – costs.

12.2 Research and Development Costs

Research, prevention and development are policy costs attributable to alcohol, illegal drugs and tobacco. They represent expenditures, usually by governments, for programs that are assumed to prevent even higher costs than would be the case if these programs were not in place. Currently the government of Canada and private institutions spend resources on research into the costs, benefits and effects of alcohol, illegal drugs and tobacco. In total, it was estimated that in 2002, \$147.6 million was spent on alcohol, illegal drugs and tobacco prevention and research in Canada 2002. Of this total, \$53.0 million was spent on alcohol, \$16.5 million on illegal drugs and \$78.1 million on tobacco prevention and research. This report used the fraction of marijuana users that make up

total illegal drug users to estimate the potential expenditures on Research, prevention and development with respect to marijuana. The below tables break down expenditures in 2002:

Costs of prevention and research attributable to alcohol, illegal drugs and tobacco in Canada, 2002				
	Cannabis	Illegal drugs		
Research	\$0.2	\$8.6		
Prevention programs	\$0	\$7.9		
Direct costs of prevention and research	\$0.2	\$16.5		

	Cannabis	Illegal drugs
Research	\$200000	\$8600000
Prevention programs	\$0	\$7900000
Direct costs of prevention and research	\$200000	\$16500000

In 2002, \$8 million was spent on research and development with respect to marijuana. If marijuana were legalized, consumption would increase and the government would likely want to increase research in order to fully assess all the impacts related to the use of marijuana.

Furthermore more money would be needed to inform citizens of the new laws and all the associated problems and benefits of consuming marijuana. If marijuana were legalized, depending on the nature of the shifts in supply and demand these administrative costs could increase or decrease, for a full breakdown of the incremental costs see appendix – Costs.

12.2.1 Fire Damage

The main form of consuming marijuana is smoking and fires caused by accidents from smoking are a major cost. It is often said, "Where there's smoke, there's fire." Research by Health Canada has found that with respect to cigarette smoke, there is a substantial increase in fires. Data analyzed between 1995 and 1999 showed 14,030 fires were started in Canada by smokers' materials. These fires killed 356 people, injured 1,615 and cost more than \$200 million in property damage. Furthermore, cigarettes are the number one known cause of fire-related fatalities in Canada, they are the leading cause of residential fires in Canada and fires started by cigarettes usually result in more deaths and more property damage than fires started by other sources¹⁶⁶. In order to assess the level of damage caused by marijuana cigarettes, the damage per tobacco cigarette was calculated and used as a measure to estimate total damages from marijuana crimes. Fire damage to property totaled \$1.19 billion in 2000. The proportion of fires that can be attributed to smoking materials (i.e., pipe, cigar, ashtray, match) was estimated to be 7.3%.¹⁶⁷

¹⁶⁶ Health Canada, 2007

¹⁶⁷ Council of Canadian Fire Marshals and Fire Commissioners, 2003

Total Damage	Smoking Damage
\$1,190,000,000.00	\$86,870,000.00

Cigarette Per Year	Number of Smokers	Total Cigarettes Consumed	Average Damage per Cigarette
1976	6,085,126.00	12024208976	0.007224592

Total Marijuana Use	Damage Per Cigarette	Total Fire Damage
199,071,000.00	0.007224592	\$1,438,206.69

If marijuana were legalized, there would be an increase in the consumption, and an increase in fires caused from smoking marijuana. The incremental increase in fire damage depends on the changes in supply and demand for a full analysis see appendix – Costs.

12.2.2 Driving under the influence of Marijuana

There is evidence that smoking marijuana and driving a vehicle leads to a higher probability of getting into a traffic accident. Experimental studies have shown that in the acute period of intoxication, cannabis negatively affects driving skills deemed necessary for safe driving. Epidemiological studies have shown that the consumption of marijuana while driving is associated with an increased risk of being injured or killed in a road accident and responsible for more on-road collisions¹⁶⁸. In 2004, there were approximately 613,000 motor vehicle collisions occurring in Canadian jurisdictions. The net result of the traffic accidents were social costs of \$63 billion. By type of collision, social costs were \$39 billion (62%), \$20 billion (32%), and \$3 billion (5%) for fatal,

¹⁶⁸ Richer and Bergeron. 2009
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injury and PDO collisions respectively¹⁶⁹. The fraction of damage for alcohol is estimated to be 19.2% and the attributable fraction for illegal drugs is estimated to be 1.7%.¹⁷⁰ See the below table for calculations for the traffic damage. Using the above estimates is calculated that marijuana related traffic accidents cost the Canadian economy approximately 900 000 dollars per year.

Figure 11.3.2 Social Cost of Traffic Accidents from Marijuana

Social Costs of Traffic Accidents	\$63000000
Percent Accidents Caused by Illegal Drugs	1.70%
% of Illegal Drug users who only use Marijuana	81.20%
Fraction of Traffic Costs for Marijuana	\$869652

If marijuana were legalized there would probably be an increase in the number of traffic accidents associated with effects of smoking marijuana. The costs of traffic accidents include the direct costs of replacing vehicles, public service costs and court costs. With a change in consumption patterns, one would expect to see a change in the social costs of marijuana related traffic accidents. These cost estimates may be biased downward, as the social stigma decreases with the legalization of marijuana it is very likely that the number of people driving under the influence of marijuana would increase disproportionately with increases in consumption and costs might be expected to be higher under legalization. With the possibility of consumption of marijuana increasing and or decreasing depending on the policy choices made by the government, the level of

¹⁶⁹ Vodden, 2007

¹⁷⁰ Rehm, 2006

damage from driving under the influence of marijuana has been assessed under all possible supply and demand shifts, for a full analysis see appendix – Costs.

12.3 Economic Loss of Income

Marijuana use can lead to economic losses with respect to lost income, this area of costs would also increase, as more people would be consuming marijuana and more people would be consuming marijuana on a more regular basis. The economic cost of lost income includes losses due to both long and short-term disability, premature mortality and productivity loss. Furthermore there is some evidence that along with other contributing factors, frequent marijuana use can significantly reduce the probability of high school graduation and findings suggest that marijuana and cocaine use in senior grades in high school grade are associated with reductions in the number of years of schooling completed¹⁷¹; resulting in longer term economic loss of productivity and income¹⁷². Studies have also indicated that illicit drug use has large, negative effects on labor supply of youth¹⁷³ and a significant positive impact on wages¹⁷⁴. One study investigated the relationship between employment and the use of marijuana for males. He used an instrumental variable procedure that identifies drug use with variables that are empirically unrelated to employment, and found that the use of each drug substantially reduces the likelihood of employment¹⁷⁵.

¹⁷¹ Chatterji, 2006

¹⁷² Yamada, 1996

¹⁷³ Kaestner, 1993

¹⁷⁴ Kaestner, 1994

¹⁷⁵ DeSimone, 2002

For a complete breakdown on the evaluation techniques used to calculate overall costs for loss or reduced productivity, see the report *The Costs of Substance Abuse in Canada: 2002*". The economic loss of income allocated to illicit drugs is broken into three main components; there is a loss of income/productivity due to premature mortality, long or short term disability and reduced productivity while at work. In order to estimate what amount was due to marijuana, this report assumes that each drug contributes the same level of loss and the fraction of marijuana users as a total of all illicit drug users was applied to each of the above cost components to find how much of each cost can be allocated to damage from marijuana, see the below table for full calculations.

Long Term Productivity losses due to premature deaths attributable to alcohol, illegal drugs and tobacco, 2002						
Methodology		Tobacco	Alcohol	Illegal drugs	TOTAL	Marijuana (81.2%)
Friction Cost Approach (Cost of Replacing Deceased Worker)		\$68,651,729	\$29,982,063	\$7,175,316	\$105,809,107	5,826,356.59
Hybrid Approach (Sum of Friction Cost and Discounted PV of Reservation Wage Stream)		\$1,873,500,753	\$922,950,888	\$248,539,187	\$3,044,990,827	201,813,819.84
Human Capital Approach (Discounted PV of Average Annual Earnings Stream)		\$3,148,630,574	\$1,822,746,428	\$468,592,279	\$5,439,969,281	380,496,930.55

Long-term disability: Productivity losses due to alcohol, illegal drugs and tobacco in , 2002				
Substance	Number of persons	Hybrid Approach	Human Capital Approach	
Illegal drugs	12,668	\$4,408,392,652	\$7,046,885,236	
Marijuana (81.2)		\$3,579,614,833.42	\$5,722,070,811.63	

Short-term disability: Income lost due to days in bed due to Marijuana, 2002
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Substance	Income lost due to days in bed	Income lost due to days in bed
Illegal drugs	\$838,366	\$21,797,508
Marijuana		\$17699576.5

For a full analysis of the incremental costs depending on the level of change in supply and demand see appendix – Costs.

13. Additional Considerations

While this report will only consider the costs and benefits monetized in the above sections and final conclusions, there are other costs and benefits which should be considered but are quantified in this report. Specifically, the use of marijuana as medicine, the impact of drug convictions on individuals and their families, potency of marijuana and tax revenues.

13.1 Drug Convictions

The first set of costs that should be considered are the costs, which are imposed on those, convicted of drug charges beyond the lost income from time spent in prison. These costs include: possible driver license suspensions as a result of being convicted of marijuana offenses, removal or suspension from public housing, loss of welfare

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payments, denial of employment opportunities with government and private agencies, loss of possible professional licensees, the cost of mandatory drug treatment and the loss in the ability to travel to countries in which having criminal offences on an individuals record are grounds for non-entry. In addition to these costs, there will be a portion of marijuana offenders with families and children; in these cases, the costs listed above will be incurred not only by the individual charged with the offence but also by their families.¹⁷⁶ Furthermore, when children are involved, there are additional expenditures by various state agencies concerned with family and social services. According to one study in the United States, 56 of all persons incarcerated had minor children, and this figure has been stable for the last decade.¹⁷⁷ With a family member incarcerated, the remaining family would be more likely to rely on public assistance programs, to help them with the potentially largest income earner, unable to provide for his/her family. This effect in turn would increase the burden on the social welfare system. Without detailed data on inmates, family characteristics, incomes and the use of social programs, these costs would be extremely difficult to put a dollar value on, but are important to note none the less.¹⁷⁸

A second cost associated with marijuana related offence is the likelihood of secondary charges. There are two groups that will be affected by the above scenario, the first are those persons who will re-appear in the justice system due to prohibition, parole violations and other failure to adhere conditions of release. If these persons did not experience parole they would have never violated parole condition, and there would be

¹⁷⁶ Bates, 2004

¹⁷⁷ Blake, 2004

¹⁷⁸ Blake, 2004

potential additional costs savings. The second set of persons affected, are those who are suspected of a marijuana offense, and are investigated and convicted of a different offense, which stemmed from the initial marijuana suspicion. These types of scenarios would be avoided, and there would be additional cost savings. Although both of these costs savings would be only marginal, if marijuana were legalized, they should still be considered in an analysis of marijuana prohibition.

As a policy maker, these additional costs and benefits should be considered and weighed when deciding whether to change the current marijuana laws. However, given the extremely large benefit cost ratios for legalization it is highly unlikely that these additional costs and benefits will change the recommendation of this report.

13.2 Issues in Dealing with Illicit Drugs - Information

One of the major issues in studying illicit drugs of any kind is the quantity and quality of data that will be assessed. This is due to the fact that these activities are illegal, which usually means that there are no 'official' sources, surveys or reports of any kind. Much of the information that is available, with respect to illicit drugs comes from both drug seizures and prosecutions of drug offenses. However, these sources may not be accurate for a number of reasons. Firstly, it is possible that authorities have overestimated the number or amount of seizures, or also given that the police are the gatekeepers to the criminal system, they may under-report or arrest persons for drug crimes for any number of reasons, which will not be discussed in this report. For example, if perhaps information regarding consumption was being measured via a proxy of drug enforcement, and there

was an intensification of drug enforcement, this could lead to increases in seizures or arrests even if consumption remains unchanged.¹⁷⁹

Aside from the 'official' sources regarding illicit drugs, the most important data has been surveys regarding consumption.¹⁸⁰ The surveys also have inherent problems for data collection and analysis. One must be critical of information, because although respondents are voluntarily providing information, they may be uncomfortable in revealing their full involvement in criminal activities.

There are also a few problems related to the price of illicit drugs. The first problem is that there is substantial price variability across both time and geography. The illegal nature of the products tends to have an effect on the price depending on a number of exogenous variables such as the laws in a given state or province, the norms and strategies of police departments and what illegal organization is supplying the drugs. In addition, due to the illegal nature of the market place and the lack of official source data, there are limits to information to both buyers and suppliers of illicit drugs. In addition it has been known that street dealers will use a number of techniques, such as spraying water on marijuana, to increase the weight, this distorting what users actually pay and what they receive. Also dealers have been known to sell marijuana at higher prices to those who purchase the product less frequently, and sell marijuana at a lower price to those who purchase marijuana more often. This effect is in part due to the fact that when marijuana is purchased in larger quantities, price falls, and more frequent users tend to purchase marijuana in larger quantities¹⁸¹.

¹⁷⁹ Daryal, 1999

¹⁸⁰ Penington. 1996

¹⁸¹ Daryal, 1999

13.3 Potency

There is evidence that when the black market controls the supply of a good both the quality and safety of the good or service can decrease dramatically. Making products illegal can make them less safe. United States experience with Alcohol Prohibition provides a classic example of this effect: deaths from adulterated alcohol soared.¹⁸² Increased potency and contamination of marijuana have been linked in the public domain to adverse mental health outcomes. Marijuana samples tested in the United States, the Netherlands, United Kingdom and Italy have shown increases in potency over the last 10 years. Increased potency has been observed in some countries, but there is enormous variation between samples, meaning that cannabis users may be exposed to greater variation in a single year than over years or decades. While the THC content is used commonly as a measure of potency, the psychoactive effect may also depend on levels of other cannabinoids, which may interact to have unknown effects. There is evidence that marijuana related problems are increasing¹⁸³. Although not supported by evidence, there is suspicion that part of the reason increases in marijuana related problems is due to the increase in potency.¹⁸⁴ One recent survey, found that one in four Australians that hydroponic cannabis poses a greater health risk than naturally grown cannabis due to greater potency and contamination.¹⁸⁵

¹⁸² Bates, 2005

¹⁸³ McRae, 2003

¹⁸⁴ McLaren, 2008

¹⁸⁵ *ibid*

13.4 Tax Revenues

The marijuana market is an illicit market in Canada, and thus not monitored or taxed, this market diverts capital away from the channels of legal government tax revenue. The existence of a vast illegal marijuana market, acts as creative destruction on the ability of our government to collect tax revenue. Although some of the funds, which are spent in this illegal market, are diluted back into the 'legal' system, the problem is that the initial purchase of marijuana is not taxed; therefore a large portion on the monies spent travel through economic channels, which avoid contributions to government revenues. The illicit marijuana market costs government through its diversion of capital from the legal economy into the black market economy ¹⁸⁶. However, taxes are not considered in this report because they are simply a transfer of funds from one party to another, it does not represent any increase in value to consumers or producers. However, this transfer does represent a change in the provision of some goods and services from the private sector to the public sector. Whether or not this change is good depends on the preferences of the people of Canada and whether or not the private or public sector is more efficient at providing these goods or services. These questions are beyond the scope of this paper and should be considered in assess the possibilities of collecting tax from the sale of marijuana.

13.5 Medical Marijuana

¹⁸⁶ Gettman, 2007

There is considerable debate across a number of fields as to the extent of the possible use for medical marijuana; such that a number of legal cases have gone all the way to the Supreme Court. Those wishing access to marijuana for medical purposes argue that obtaining marijuana legally is still sometimes difficult and subject to a number of unjust government policies that are based on outdated beliefs about marijuana. If marijuana were legalized or decriminalized there would be substantial benefits to those seeking access to marijuana for both empirically tested results and possible anecdotic case study results.¹⁸⁷ Although marijuana has been used for thousands of years across a number of different cultures, this evidence does and should not constitute the proof needed to justify the use of medical marijuana, nor does it provide evidence for a benefit cost perspective. As marijuana becomes more regarded a plant with so many medical purposes, one cannot continue to ignore the potential benefits of legalizing marijuana. The main uses of medical marijuana include use for Cancer Chemotherapy, Glaucoma, Epilepsy, Multiple Sclerosis, AIDS and chronic pain.

In a survey on the scientific evidence carried out over the past thirty years on the possible uses of marijuana as medicine, meta-analysis was conducted and identified several pathologies in which controlled studies on cannabinoids have been published: nausea and vomiting associated with cancer chemotherapy, loss of appetite, pain, multiple sclerosis, epilepsy, glaucoma, Parkinson disease and dystonia¹⁸⁸.

Cancer chemotherapy and AIDS treatment frequently causes nausea and vomiting which vary in intensity, but which can sometimes be severe and prolonged; and one of

¹⁸⁸ Amar, 2005

the worst side effects of the treatment of cancer and AIDS/HIV. For many patients the side effects of treatment are worse than the actual cancer or AIDS/HIV itself. In the clinical trials conducted, the evidence shows marijuana is useful in combating these negative side effects. The result of studies have been that the antiemetic effect of THC is significantly superior to a placebo, to other prescription drugs (such as prochlorperazine) and of the derivatives of marijuana that have been in use such as Marinol and Nabilone¹⁸⁹.

For HIV/AIDS patients, marijuana has significant evidence that it can be useful for certain conditions; particularly chronic pain experienced by HIV-positive patients. Woolridge found that about one-third (27%) reported using cannabis for treating symptoms of HIV/AIDS treatment and that; 97% reported improved appetite, 94% reduced muscle pain, 93% reduced nausea, and 90% reduced nerve pain.¹⁹⁰ The most recent research, in the marijuana-HIV/AIDS debate, found that smoking marijuana reduced daily pain, from treatment, by an average of 34%¹⁹¹.

Another major side effect of both chemotherapy and HIV /AIDS treatment is the loss of appetite and progressive weight loss. There is evidence that both marijuana and dronabinol (a pure isomer of THC) can significantly increase caloric intake, and for experienced marijuana smokers with clinically significant muscle mass loss, both dronabinol and marijuana produce substantial and comparable increases in food intake without producing adverse effects¹⁹². The only downside of the current research is that despite the many trials with marijuana against pain, nausea and choleretic intake none have compared their efficacy against newer generation agents. The advent of science however,

¹⁸⁹ Amar, 2005, Cinti, 2009

¹⁹⁰ Woolridge, et al, 2005

¹⁹¹ Cinti, 2009

¹⁹² Haney 2005

is inevitable, because newer processes or drugs may in the future be more effective or efficient, does not warrant what is currently effective as useful today.

There have been several cannabinoids which have been proved to be effective analgesics in acute and chronic pain. The most recent literature confirms that for almost every study on a variety of analgesics cases for different types acute and chronic pain, marijuana provided moderate to high relief of pain.¹⁹³ In the most recent study on the analgesic properties of marijuana reviewed meta-analysis, double-blind and randomized controlled trials that compared cannabis consumption to both placebo and other prescription drugs among subjects with chronic pain, found that the available evidence suggests that cannabis treatment is moderately efficacious for treatment of chronic pain.¹⁹⁴

Marijuana can also be effective in controlling the negative side effects of multiple sclerosis (MS). The results of the clinical trials are positive, some cases showed an improvement in spasticity, muscle spasms, pain, sleep quality, tremors and their general condition, and some found that marijuana had no effect on the symptoms of MS. It has been reported an absence of beneficial effects of cannabinoids on spasticity but they found an improvement in mobility with oral THC, and a subjective improvement in spasticity, muscle spasms, pain, sleep quality, and general condition; as well as a decrease in hospitalizations for relapses with the other forms of marijuana.¹⁹⁵ The most recent controlled studies, however have all reported that marijuana has had positive impacts on MS. In the most recent of the studies on MS and marijuana, the researchers

¹⁹³ Amar, 2005

¹⁹⁴ Martín-Sánchez, Eva et al 2009

¹⁹⁵ Zajicek et al, 2003

found that in regards to MS “preclinical findings that suggest that as well as ameliorating signs and symptoms of multiple sclerosis, cannabinoid CB₁ and/or CB₂ receptor activation may suppress some of the pathological changes that give rise to these signs and symptoms”.¹⁹⁶

Epilepsy is a common chronic neurological disorder characterized by recurrent unprovoked seizures that affects about 1% of the world’s population. It is estimated that about 20–30% of epileptics are not adequately controlled with conventional drugs. Scientific research for human subjects on the effects of marijuana on seizures and epilepsy are inconclusive. THC and its derivatives however have been promising in animal studies to help with epilepsy. The evidence thus far has been mostly restricted to animal tests and somewhat anecdotal evidence, however these results look promising for helping treat some cases of epilepsy¹⁹⁷. Evidence has found that marijuana and its active cannabinoids have certain antiepileptic effects, specific to certain types of seizures. The first of the uncontrolled clinical studies have shown positive result, that marijuana and/or its constituents have antiepileptic effects in humans. There has only been one controlled clinical study, in which 8 patients in a randomized, double blind, parallel group study used marijuana to help alleviate epilepsy¹⁹⁸. Of the 8 patients receiving THC, four subjects remained virtually convulsion-free for the duration of the study and three other subjects exhibited a clinical improvement. There have been recent case studies supports other anecdotal data suggesting that marijuana use may be a beneficial adjunctive treatment in some patients with epilepsy. A recent case study on a 45-year-old man with

¹⁹⁶ Pertwee 2007

¹⁹⁷ Chiu 2007

¹⁹⁸ Amar, 2005

cerebral palsy and epilepsy showed significant improvement with the use of marijuana on the negative side-effects of his diseases.¹⁹⁹

Glaucoma is an eye affliction, which can lead to blindness, characterized by an increase in intraocular pressure. Several anecdotal reports observe that cannabis has the power to reduce the fluid pressure within the eye (see for example many of the cases presented in Chapkis, Wendy and Webb 2008 and Grinspoon and Bakalar 1993). In clinical research marijuana has been found to reduce significantly intraocular pressure (IOP). Still the scientific community argues that the use of cannabis for treating glaucoma is unsatisfactory, because its beneficial effects are limited by: its short-term action (a few hours), the incidence of undesirable central and peripheral reactions.²⁰⁰ More research is required to substantiate earlier results and to resolve apparent contradictions.²⁰¹ The American Glaucoma Society just released their official statement regarding marijuana and the treatment of Glaucoma. The statement concluded that marijuana does in fact lower the IOP temporarily; IOP lowering is only one consideration in slowing the optic nerve damage of glaucoma. An exciting finding in the past decade is the discovery of receptors for the active components of marijuana in the tissues of the eye itself suggesting that the local administration of THC has the possibility of being effective. This raises the hope that marijuana or related compounds could protect the optic nerve and help fight glaucoma”.²⁰²

Since the FDA has allowed independent researchers access to marijuana for scientific evaluation over 15 years ago, there has been great progress in understanding the

¹⁹⁹ Mortati, Dworetzky and Decinsky 2007

²⁰⁰ Goldberg, 2007

²⁰¹ Goldberg, 2007

²⁰² Jampel, 2010

mechanisms of THC and other marijuana derivatives, with respect to potential therapeutic uses. The research has shown clear scientific and anecdotal evidence that marijuana can be useful in treating AIDS/Cancer patients, various forms of chronic pain, helps in the treatment of multiple sclerosis, epilepsy, and acts as a appetite simulate in debilitating diseases. For each area of benefit, it is still unclear as what type of appropriate marijuana administration is the most suitable in terms of maximizing the potential effects and minimizing the adverse effects of marijuana and THC.

This section reviewed the current literature on the potential uses of medical marijuana, and concludes that marijuana does have a number of potential therapeutic uses. There is substantial reason to believe that the legalization will on top of the benefits outlined in this report, also help those seeking to use marijuana as medicine. Furthermore legalization will remove many of the barriers for those already seeking marijuana under the current Canadian medical marijuana system. Finally the legalization of marijuana would allow for private organizations to research and develop more effective and efficient uses for medical marijuana, which would add to the already expansive benefits of legalizing marijuana.

14. Conclusion

The first section of this paper analyzed each of the major arguments put forth against the legalization of marijuana and found that apart from the negative health consequences from inhaling marijuana smoke; there are no rational arguments for any of the underlying assumption of marijuana is bad. This paper has established that marijuana addition is not a concern there is no connection between marijuana use and violence, that marijuana is not a serious health concern, that there is no link between marijuana use and violence and that the Gateway Theory is unfounded.

The second section of this paper assessed the economic impact of a possible change in marijuana laws. In order to assess all of the costs and benefits various demand and supply curves had to be derived and analyzed to assess the incremental changes in costs and benefits due to shifts in the equilibrium consumption of marijuana.

This paper is unable to precisely estimate the exact changes in supply and demand due to the lack of concrete empirical work on the legalization of marijuana. We hope to provide some insight into the possible effects by considering the empirical and theoretical work done on marijuana decriminalization, and applying this knowledge to the Canadian context to get a better idea of the exact workings of a legalized marijuana market.

Policy makers with their ability to levy taxes and subsidizes and regulation are presented with a variety of possible outcomes depending on the use of these public tools. A rational policy maker could use the information provided in this report and these three tolls together to implement a law change that would result in the highest net benefit to Canadian society.

Furthermore this paper is unable to precisely estimate exact changes in supply and demand due to the lack of concrete empirical work on the legalization of marijuana. Policy makers with their ability to levy taxes, subsidies and regulation are presented with a variety of possible outcomes depending on the implementation of these public tools. A rational policy maker could use these three tools together to implement a law change that would result in the highest net benefit to the Canadian public.

14.1 Benefits

Almost all of the possible changes in supply and demand led to total net benefits as positive. The below table summarizes all of the ‘fixed’ benefits from marijuana legalization. These are benefits are fixed because they will accrue regardless of whether consumption patterns change. The total fixed benefit from marijuana legalization in Canada is approximately 1.7 billion dollars.

Fixed Benefits	2009 Dollars
Police	\$239,324,406.45
Prison	\$301,335,986.41
Court	\$108,381,345.16
Organized Crime	\$1,137,396,904.64
Total	\$1,786,438,642.67

The total results are listed below in the following tables. The first set of tables are the benefits accrued due to marijuana legalization calculated for each of the possible supply and demand shifts, and resulting change in percent consumed. The total column is the

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sum of the total of the fixed benefits and the total of the change in surplus from the resulting shifts in the supply and demand framework. For a detailed explanation of the change in surplus see the above section on economic surplus and the total results in appendix – Surplus.

% Change in Q	Change in Surplus	Total Savings
0.070384326	1,636,398,748.76	3,422,837,391.42
0.121929164	1,752,376,688.66	3,538,815,331.33
0.224415976	1,955,436,941.40	3,741,875,584.07
0.52976639	2,424,868,957.36	4,211,307,600.03
1.042803316	2,971,295,143.20	4,757,733,785.87
-0.017332329	1,347,147,695.14	3,133,586,337.81
-0.084250188	1,207,948,344.97	2,994,386,987.64
-0.187641296	811,830,962.91	2,598,269,605.57
-0.490278824	-2,533,638,716.94	-747,200,074.27

% Change in Q	Change in Surplus	Total Savings
0.091484552	1,829,956,644.64	3,616,395,287.30
0.143632253	1,951,190,987.72	3,737,629,630.39
0.248229088	2,162,042,093.15	3,948,480,735.82
0.55990957	2,649,672,498.85	4,436,111,141.52
1.077467973	3,221,400,130.27	5,007,838,772.94
-0.012810852	1,548,376,799.51	3,334,815,442.18
-0.091785983	1,483,501,237.13	3,269,939,879.79
-0.171363979	971,134,371.53	2,757,573,014.20
-0.480331575	-2,506,319,181.35	-719,880,538.68

% Change in Q	Change in Surplus	Total Savings
0.134287867	2,195,319,558.43	3,981,758,201.10
0.188545592	2,326,401,139.19	4,112,839,781.86
0.296156745	2,556,360,659.12	4,342,799,301.78

0.620195931	3,081,480,866.52	4,867,919,509.18
1.163074604	3,694,682,542.15	5,481,121,184.81
0.024868124	1,895,384,543.81	3,681,823,186.48
0.142426526	1,451,369,405.38	3,237,808,048.05
-0.139412208	1,271,527,101.77	3,057,965,744.44
-0.471590053	-2,408,060,411.18	-621,621,768.52

% Change in Q	Change in Surplus	Total Savings
0.155086662	2,378,513,858.99	4,164,952,501.65
0.210248681	2,514,795,751.08	4,301,234,393.75
0.319969857	2,752,985,379.71	4,539,424,022.37
0.650339111	3,297,227,179.47	5,083,665,822.13
1.19743783	3,937,185,524.29	5,723,624,166.96
0.044159759	2,066,090,932.80	3,852,529,575.46
-0.011906556	1,881,052,726.16	3,667,491,368.83
-0.123737754	1,421,074,274.64	3,207,512,917.30
-0.450188395	-2,470,878,352.55	-684,439,709.89

% Change in Q	Change in Surplus	Total Savings
0.205727204	2,842,488,690.54	4,628,927,333.20
0.264204974	2,989,123,172.41	4,775,561,815.08
0.378447626	3,250,538,740.04	5,036,977,382.70
0.736548606	3,837,958,420.45	5,624,397,063.11
1.300828937	4,539,785,154.23	6,326,223,796.90
0.090580256	2,499,168,920.76	4,285,607,563.42
0.031801055	2,297,760,223.15	4,084,198,865.81
-0.084853052	1,795,236,182.56	3,581,674,825.23
-0.437528259	-2,380,099,624.13	-593,660,981.46

14.2 Costs

The total costs from marijuana legalization are dependent on the level of change in consumption. If marijuana consumption increases then costs should also increase, if

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marijuana consumption falls then the costs of marijuana fall. There are no fixed costs in marijuana criminalization or legalization so all of the costs are dependent on the total percentage change in total consumption of marijuana. The below tables highlight the total health care costs, research and development costs, fire damage costs, traffic accidents costs and the economic loss of income. Each of these costs are based on the total costs derived in the economic analysis section of this paper, they are the incremental costs above and beyond the current costs from marijuana consumption based in the respective increase in consumption.

Total Costs						
% Δ Q	Health Care	RnD	Fire	Traffic	Income Loss	Total
0.070	13,396,899.86	1,161,341.38	101,227.21	61,209.87	253,604,634.33	268,325,312.65
0.122	23,207,905.70	2,011,831.21	175,359.34	106,035.94	439,327,941.44	464,829,073.62
0.224	42,715,168.69	3,702,863.60	322,756.56	195,163.80	808,602,351.78	855,538,304.43
0.530	100,835,337.65	8,741,145.44	761,913.57	460,712.40	1,908,822,876.54	2,019,621,985.59
1.043	198,486,401.66	17,206,254.71	1,499,766.71	906,875.99	3,757,367,139.33	3,975,466,438.40
-						
0.017	-3,299,022.51	-285,983.43	-24,927.47	-15,073.09	-62,450,821.20	-66,075,827.71
-						
0.084	-16,036,117.64	-1,390,128.10	-121,169.18	-73,268.34	-303,565,286.97	-321,185,970.24
-						
0.188	-35,715,503.66	-3,096,081.38	-269,866.97	163,182.63	-676,098,003.10	-715,342,637.74
-						
0.490	-93,319,303.93	-8,089,600.60	-705,122.28	426,371.96	1,766,543,617.71	1,869,084,016.48

% Δ Q	Health Care	RnD	Fire	Traffic	Income Loss	Total
0.091	17,413,101.07	1,509,495.11	131,573.69	79,559.72	329,631,718.82	348,765,448.41
0.144	27,338,855.39	2,369,932.17	206,572.87	124,910.08	517,527,226.17	547,567,496.68
0.248	47,247,738.58	4,095,779.95	357,004.74	215,872.92	894,404,346.41	946,320,742.60
0.560	106,572,767.94	9,238,507.91	805,265.69	486,926.48	2,017,432,997.23	2,134,536,465.24
1.077	205,084,446.49	17,778,221.55	1,549,621.65	937,022.18	3,882,268,778.13	4,107,618,090.00
-						
0.013	-2,438,407.97	-211,379.06	-18,424.65	-11,140.98	-46,159,303.09	-48,838,655.76
-						
0.092	-17,470,475.22	-1,514,468.72	-132,007.21	-79,821.86	-330,717,817.14	-349,914,590.16
-						
0.171	-32,617,291.34	-2,827,505.65	-246,456.82	149,027.03	-617,448,538.65	-653,288,819.49
-						
0.480	-91,425,952.01	-7,925,470.99	-690,816.08	417,721.31	1,730,702,279.33	1,831,162,239.72

% Δ Q	Health Care	RnD	Fire	Traffic	Income Loss	Total
0.134	25,560,251.97	2,215,749.81	193,133.71	116,783.71	483,858,088.04	511,944,007.23
0.189	35,887,626.68	3,111,002.27	271,167.53	163,969.05	679,356,308.88	718,790,074.41
0.296	56,370,252.89	4,886,586.29	425,934.61	257,553.31	1,067,094,441.19	1,129,034,768.29
0.620	118,047,628.71	10,233,232.86	891,969.94	539,354.63	2,234,653,242.21	2,364,365,428.35
1.163	221,378,748.48	19,190,730.97	1,672,741.68	1,011,470.16	4,190,721,520.17	4,433,975,211.05
0.025	4,733,380.09	410,324.05	35,765.50	21,626.61	89,603,351.37	94,804,447.62
0.142	27,109,358.22	2,350,037.68	204,838.78	123,861.51	513,182,822.06	542,970,918.26
-						
0.139	-26,535,615.19	-2,300,301.43	-200,503.57	-121,240.11	-502,321,809.99	-531,479,470.29
-						
0.472	-89,762,097.26	-7,781,235.87	-678,243.97	-410,119.23	1,699,205,345.05	1,797,837,041.39

% Δ Q	Health Care	RnD	Fire	Traffic	Income Loss	Total
0.155	29,519,079.02	2,558,929.92	223,046.67	134,871.43	558,799,074.19	591,235,001.24
0.210	40,018,576.37	3,469,103.24	302,381.06	182,843.19	757,555,593.62	801,528,497.47
0.320	60,902,822.79	5,279,502.64	460,182.79	278,262.43	1,152,896,435.81	1,219,817,206.45
0.650	123,785,059.00	10,730,595.33	935,322.06	565,568.71	2,343,263,362.90	2,479,279,908.01
1.197	227,919,419.17	19,757,724.20	1,722,163.10	1,041,354.20	4,314,537,060.64	4,564,977,721.30
0.044	8,405,335.43	728,636.02	63,510.86	38,403.62	159,113,827.89	168,349,713.83
-						
0.012	-2,266,284.95	-196,458.17	-17,124.09	-10,354.56	-42,900,997.31	-45,391,219.08
-						
0.124	-23,552,151.36	-2,041,672.94	-177,960.47	-107,608.79	-445,844,545.79	-471,723,939.35
-						
0.450	-85,688,521.72	-7,428,108.52	-647,463.96	-391,507.24	1,622,092,158.64	1,716,247,760.07

% Δ Q	Health Care	RnD	Fire	Traffic	Income Loss	Total
0.206	39,157,961.83	3,394,498.87	295,878.24	178,911.07	741,264,075.51	784,291,325.53
0.264	50,288,576.75	4,359,382.07	379,981.36	229,766.38	951,967,712.53	1,007,225,419.10
0.378	72,033,437.51	6,244,385.83	544,285.91	329,117.73	1,363,600,069.23	1,442,751,296.21
0.737	140,194,109.67	12,153,052.00	1,059,309.13	640,540.97	2,653,888,308.80	2,807,935,320.57
1.301	247,598,804.99	21,463,677.46	1,870,860.88	1,131,268.49	4,687,069,773.16	4,959,134,384.98
0.091	17,240,978.04	1,494,574.22	130,273.13	78,773.30	326,373,413.03	345,318,011.73
0.032	6,052,988.98	524,717.41	45,736.49	27,655.85	114,583,677.69	121,234,776.41
-						
0.085	-16,150,866.33	-1,400,075.36	-122,036.23	-73,792.63	-305,737,490.82	-323,484,261.36
-						
0.438	-83,278,800.92	-7,219,216.27	-629,256.07	-380,497.33	1,576,475,906.50	1,667,983,677.09

14.3 Net Result

The net result was calculated by subtracting total economic benefits from total economic costs. The benefit cost ratio is the ratio of benefits to costs. The following tables highlight the results for each of the respective changes in total consumption.

% Change in Q	Net Benefit	Ratio
0.070384326	3,154,512,078.77	12.75629704
0.121929164	3,073,986,257.71	7.613154022
0.224415976	2,886,337,279.63	4.373709002
0.52976639	2,191,685,614.44	2.085195958
1.042803316	782,267,347.47	1.196773727
-		-
-0.017332329	3,199,662,165.51	47.42409511
-		-
-0.084250188	3,315,572,957.88	9.322907179
-		-
-0.187641296	3,313,612,243.31	3.632202903
-0.490278824	-2,616,284,090.75	0.399768051

% Change in Q	Net Benefit	Ratio
0.091484552	3,267,629,838.89	10.36913291
0.143632253	3,190,062,133.71	6.825879281
0.248229088	3,002,159,993.22	4.172455023
0.55990957	2,301,574,676.28	2.078255028
1.077467973	900,220,682.94	1.219158808
-0.012810852	3,383,654,097.93	-
-0.091785983	3,619,854,469.95	-
-0.171363979	3,410,861,833.68	-
-0.480331575	-2,551,042,778.41	0.393127667

% Change in Q	Net Benefit	Ratio
0.134287867	3,469,814,193.87	7.777722065
0.188545592	3,394,049,707.45	5.721892842
0.296156745	3,213,764,533.49	3.84647083
0.620195931	2,503,554,080.83	2.058869349
1.163074604	1,047,145,973.36	1.236164147
0.024868124	3,587,018,738.86	38.8359753
0.142426526	2,694,837,129.79	5.963133456
-0.139412208	3,589,445,214.73	-
-0.471590053	-2,419,458,809.90	0.345760908

% Change in Q	Net Benefit	Ratio
0.155086662	3,573,717,500.42	7.044495832
0.210248681	3,499,705,896.28	5.366290041
0.319969857	3,319,606,815.92	3.721396942
0.650339111	2,604,385,914.13	2.050460622
1.19743783	1,158,646,445.66	1.25381207
0.044159759	3,684,179,861.63	22.88408746
-0.011906556	3,712,882,587.91	-
-0.123737754	3,679,236,856.65	-
-0.450188395	-2,400,687,469.96	0.39880006

% Change in Q	Net Benefit	Ratio
0.205727204	3,844,636,007.68	5.902050912
0.264204974	3,768,336,395.98	4.741303907
0.378447626	3,594,226,086.49	3.491230537
0.736548606	2,816,461,742.54	2.003036545
1.300828937	1,367,089,411.92	1.275670975
0.090580256	3,940,289,551.69	12.41061114
0.031801055	3,962,964,089.40	33.68834411
-	-	-
-0.084853052	3,905,159,086.59	11.07217646
-0.437528259	-2,261,644,658.55	0.355915342

The below table is a selection of three possible alternatives that we feel should be highlighted as the most realistic changes in supply and demand.

	Demand	Supply	Net Benefit (Billions)	BC - Ratio
Low	up by 2%	up by 5%	3.154	12.75
High	up by 8%	down by 20%	3.589	5.75
Predicted	up by 8%	up by 20%	3.213	3.84

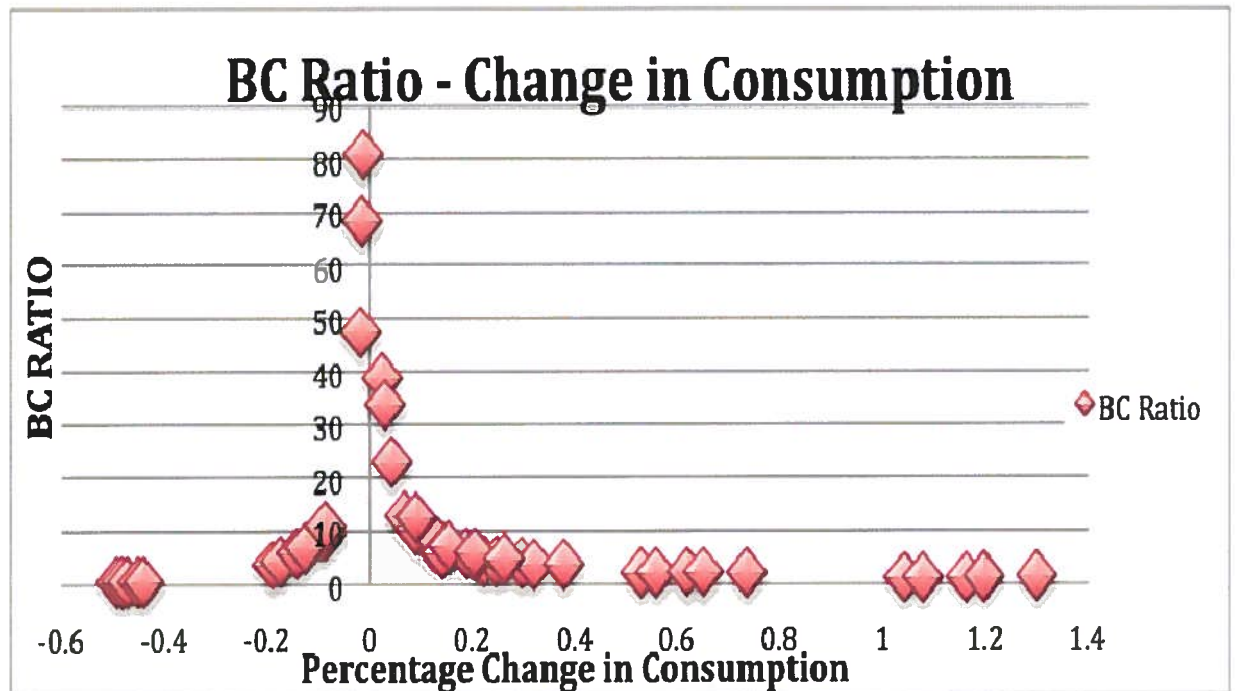
The first scenario that was considered was that of low impact, such that the legalization of marijuana would cause only a small shift up in consumer demand and a small increase in the level of supply. The lowest impact scenario results in the highest net benefits for Canada. As many of the benefits are fixed, independent of consumption patterns, whereas the costs of marijuana legalization are proportional to the increase or decrease in consumption patterns. These scenarios capture almost all of the benefits and

lead to little increase in consumption and therefore have the smallest level of incremental costs.

The next scenario that we wish to highlight is that of a high impact change. This scenario would occur if marijuana legalization resulted in a higher level of consumption a supply shift downwards(due to the increased cost of production under legalized regime). The total level of benefits here is still positive, but smaller than the low impact scenario because now consumption has increased by approximately 8 percent and therefore causes the incremental costs to increase.

The final scenario that this report wishes to stress is what we call ‘predicted’ out of marijuana legalization. The author of this report, based on research and analysis of decriminalization studies that the legalization of marijuana would result in an increased in consumption by approximately 8 percent and an upward shift in the supply by approximately 20 percent. Although the risk premium (and subsequent shifts in supply) has been estimated to be in the range of 200 – 300 percent, in all likelihood the Canadian marijuana market would be heavily regulated by government, which would push down the potential drastic increase in supply.

Furthermore from analysis the data it appears as if there is a relationship between the change in consumption and the benefit cost ratio. As consumption changes in either a positive or negative direction from zero the level of net benefits falls, (see the below chart). Policy makers could use these results to select the best means of legalized marijuana in order to capture the highest net level of benefits.



Whether marijuana legalization is desirable depends on number factors not just the economic budgetary impacts discussed in this report. However, this economic analysis and the above discussion of the underlying assumptions of why drugs are bad showing that there are 'high' levels of potential benefits if marijuana were legalized. Canada is a democratic capitalistic country and should create policy based on an objective standard of values. This report has shown that marijuana legalization has high economic benefits, and that the underlying assumptions of why marijuana is bad are unfounded. Marijuana laws in Canada need to be reformed, there are no rational grounds fro restricting ones liberty and freedoms to engage any activity involving one of Canada's best resources; marijuana

15. Appendix

15.1 Figure 4.1 Symptoms Reported in Studies of Cannabis Abstinence

TABLE 1. Presence or Absence of Symptoms Reported in Studies of Cannabis Abstinence, 1946-2004

Study	Year	Sample Size	Study Subjects and Method	Presence or Absence of Symptoms ^a		
				Irritability	Nervousness/ Anxiety	Restlessness
Human experimental studies						
Williams et al. (21)	1946	6	Inpatients; abstinence from smoked marijuana and pyrahexyl		Y	Y
Dornbush et al. (22)	1972	5	Inpatients; abstinence from smoked marijuana; specific symptoms not reported			
Georgotas et al. (23)	1979	5	Inpatients; abstinence from smoked marijuana	Y		
Jones et al. (24-26) ^b	1976, 1981	12-53	Inpatients; abstinence from oral THC	Y	Y	Y
Nowlan and Cohen (27)	1977	30	Inpatients; abstinence from smoked marijuana	Y		Y
Stefanis et al. (29)	1976	16	Inpatients; abstinence from smoked hashish, marijuana	N	N	N
Haney et al. (30)	1999	12	Inpatients; abstinence from oral THC	Y	Y	Y
Haney et al. (31)	1999	12	Inpatients; abstinence from smoked marijuana	Y	Y	N
Haney et al. (35)	2001	10	Inpatients; abstinence from smoked marijuana	Y		Y
Hart et al. (32) ^c	2002		Inpatients; effects of smoked marijuana, oral THC	Y/N	N/N	N/N
Haney et al. (33)	2003	7	Inpatients; abstinence from smoked marijuana	Y	Y	Y
Haney et al. (34)	2004	7	Inpatients, outpatients; abstinence from smoked marijuana	Y	Y	
Kouri et al. (38)	1999	17	Outpatients; abstinence from smoked marijuana		Y	
Kouri et al. (39)	2000	30	Outpatients; abstinence from smoked marijuana	Y	Y	
Budney et al. (40)	2001	12	Outpatients; abstinence from smoked marijuana	Y	N	Y
Budney et al. (41)	2003	18	Outpatients; abstinence from smoked marijuana	Y	Y	Y
Interview/survey studies						
Crowley et al. (52)	1998	180	Inpatient adolescent, drug abusers; structured interview	Y	Y	Y
Weisbeck et al. (42)	1996	5,611	Alcoholics and probands; structured interview		Y	Y
Budney et al. (51)	1999	54	Adults enrolled in treatment; symptom checklist	Y	Y	Y
Total ^d				14/16	12/16	11/15

^a Y=symptom was reported; N=symptom was assessed but did not occur. Blank cells indicate either that the symptom was not assessed or that it could not be determined whether the symptom was assessed.

^b The three references to research conducted by Jones et al. are presented jointly because the articles overlap and provide information from the same series of studies.

^c The study reported on abstinence effects from both smoked marijuana and oral THC; the symptom reports indicate findings for smoked marijuana and oral THC, respectively.

^d Number of studies that found positive results/number of studies with data available.

Budney, 2006

15.2 Figure 6.2: Size Effects of Illicit Drugs on Crime Measures

Table 2
Individual effect sizes

Author date	Drug measure	Crime measure	OR	CI	p
Santo et al. (1980)	HR drug use (S)	Arrest (S)	1.74	1.45–2.09	0.0001
McBride (1981)	Heroin (S)	Property	1.25	0.64–2.44	NS
Hunt et al. (1984)	Heroin (S)	Property (S)	2.63	1.51–4.57	0.0001
Mott (1986)	Addict (R)	Conviction	1.20	0.45–3.20	NS
Wish (1986)	PCP (U)	Theft (R)	1.17	0.92–1.48	NS
Dembo et al. (1987)	Marijuana (U)	Felony (R)	4.67	1.14–19.15	0.03
Parker and Newcombe (1987)	Opiate (R)	Theft (R)	0.95	0.57–1.61	NS
Johnson et al. (1991)	Cocaine (S)	Delinquency (S)	2.50	1.53–4.07	0.0001
Harrison and Groeffler (1992)	Cocaine (S)	Shoplifting (S)	7.23	6.02–8.69	0.0001
Kuhns et al. (1992)	Heroin (S)	Prostitution (S)	5.53	1.71–17.84	0.0001
Kokkevi et al. (1993)	Drug use (S)	Conviction (S)	3.22	1.61–6.45	0.0001
Nurco et al. (1993)	Opiate (R)	Crime (S)	2.90	1.89–4.45	0.0001
Dembo et al. (1994)	Cocaine (S)	Sold cocaine (S)	2.26	1.13–4.51	0.02
Graham and Wish (1994)	Heroin (S)	Prostitution (S)	2.74	1.37–5.48	0.02
Johnson et al. (1994)	Crack (S)	Shoplifting (S)	2.83	1.10–7.30	0.03
Klee and Morris (1994)	Heroin (S)	Shoplifting (S)	1.34	0.76–2.36	NS
Webb and Delone (1996)	Crack (S)	Felony (R)	2.72	1.63–4.54	0.0001
Morentin et al. (1998)	Heroin (R)	Recidivism (R, S)	6.90	4.65–10.23	0.0001
Hammersley et al. (1999)	Ecstasy (S)	Shoplifting (S)	3.22	0.93–11.08	NS
Makkai and Feather (1999)	Opiate (U)	Property (R)	5.27	2.58–10.78	0.0001
Bennett (2000)	Heroin (S)	Shoplifting (S)	8.54	5.82–12.54	0.0001
French et al. (2000)	Drug use (S)	Property (S)	8.09	7.02–9.32	0.0001
Hawke et al. (2000)	Amphetamine (S)	Property (S)	2.39	1.44–3.97	0.0001
Farabee et al. (2001)	Heroin (S)	Arrest (S)	1.24	0.89–1.72	NS
Gilchrist et al. (2001)	Drug use (S)	Prison (S)	0.29	0.03–2.49	NS
Turpeinen (2001)	Opiate (S)	Prison (R)	10.18	1.20–86.69	0.03
Yacoubian et al. (2001)	Opiate (U)	Prostitution (R)	0.76	0.35–1.65	NS
Born and Gavray (2002)	Drug use (S)	Theft (S)	14.17	1.68–119.22	0.01
Yacoubian et al. (2002)	Ecstasy (S)	Property (R)	0.75	0.31–1.86	NS
Holloway and Bennett (2004)	Heroin (S)	Property (S)	20.94	14.72–29.80	NS
Fixed effects			3.78	3.52–4.05	0.0001
Random effects			2.79	1.96–3.98	0.0001

Notes: OR=Odds Ratio, CI=Confidence Interval, S=Self-report, R=Records, p=probability of z, NS=Not Significant.

Bennett, Trevor, Holloway, Katy and Farrington, David. “The statistical association between drug misuse and crime: A meta-analysis”. *Aggression and Violent Behaviour*. 13 (2008) 107118

15.3 Figure 6.3: Individual and mean effect sizes for marijuana and amphetamines

Table 4
Individual and mean effect sizes for marijuana and amphetamines

Author date	Drug measure	Crime measure	OR	CI	p	Design
Marijuana						
McBride (1981)	Marijuana	Property crime	2.18	1.26–3.76	0.005	3
Dembo et al. (1987)	Marijuana	Conviction	4.67	1.14–19.15	0.03	3
Johnson et al. (1991)	Marijuana	Crime	1.86	1.44–2.40	0.0001	3
Kuhns et al. (1992)	Marijuana	Prostitution	2.51	0.70–8.96	NS	3
Dembo et al. (1994)	Marijuana	Supply	0.91	0.45–1.81	NS	3
Graham and Wish (1994)	Marijuana	Prostitution	1.40	0.40–4.93	NS	3
Johnson et al. (1994)	Marijuana	Shoplifting	0.26	0.06–1.14	NS	1
Webb and Delone (1996)	Marijuana	Arrest	1.39	1.11–1.73	0.004	3
Makkai and Feather (1999)	Marijuana	Property crime	1.45	0.84–2.50	NS	3
Yacoubian et al. (2001)	Marijuana	Prostitution	0.98	0.58–1.65	NS	3
(n = 10)						
Fixed effects			1.51	1.31–1.74	0.0001	
Random effects			1.46	1.13–1.88	0.004	
Amphetamines						
McBride (1981)	Amphetamines	Property crime	1.24	0.76–2.04	NS	3
Kuhns et al. (1992)	Amphetamines	Prostitution	3.67	1.54–8.70	0.003	3
Makkai and Feather (1999)	Amphetamines	Property crime	1.69	0.77–3.71	NS	3
Hawke et al. (2000)	Amphetamines	Property crime	2.39	1.44–3.97	0.0007	2
Yacoubian et al. (2001)	Amphetamines	Prostitution	0.91	0.37–2.27	NS	3
Turpeinen (2001)	Amphetamines	Prison	3.79	1.42–10.13	0.007	2
(n = 6)						
Fixed effects			1.86	1.41–2.44	0.0001	
Random effects			1.93	1.27–2.93	0.002	

Notes: OR = Odds Ratio, CI = Confidence Interval, p = probability of z, NS = Not Significant, Design = Comparison method: 1 = D1vD0 (Drug use compared with no drug use), 2 = D1vD2 (Drug use compared with other drug use), 3 = D1vD2/D0 (Drug use compared with other drug use and no drug use).

Bennett, Trevor, Holloway, Katy and Farrington, David. “The statistical association between drug misuse and crime: A meta-analysis”. *Aggression and Violent Behaviour*. 13 (2008) 107118

16. Appendix – Price

Potential Drug Proceeds Net at Street Level for 2007		
Drug	Units	Price/Unit
Cannabis Plant	1,878,178	\$1,000
Cannabis	49,918,000	\$10
Hash	227,000	\$10
Hash Oil	115,000	\$10

Senate of Canada, 2002

Drug Prices and Purity Levels: Selected Years 1981-1998					
Price Per Gram	1981	1988	1996	1997	1998
10 g or less	\$6.41	\$12.50	\$10.42	\$10	\$10.41
100-999 g	2.75	3.41	2.95	2.63	2.59

Senate of Canada, 2002

City	Price Per Gram	Price Per Ounce	Year
Vancouver	\$7.50	\$220.00	2008
Hull	\$7.00	\$160.00	2008
Charlottetown	\$10.00	\$240.00	2009
Burnaby	\$10.00	\$220.00	2008
Ottawa	\$10.00	\$180.00	2008
Montreal	\$10.00	\$200.00	2007
Regina	\$10.00	n/a	2008
Winnipeg	\$10.00	\$230.00	2008
Waterloo	\$10.00	\$200.00	2008
St Johns	\$10.00	\$240.00	2006
Toronto	\$12.00	\$240.00	2008
Peterborough	\$10.00	n/a	2008
Medicine Hat	\$10.00	\$240.00	2008
London	\$10.00	n/a	2006
Mississauga	\$10.00	\$180.00	2008
North Bay	\$10.00	\$210.00	2009
Quebec City	\$10.00	\$200.00	2007
Fort McMurray	\$15.00	n/a	2008
Oshawa	\$10.00	\$170.00	2008
Thunder Bay	\$15.00	\$240.00	2008
Pembroke	\$10.00	n/a	2007
Surrey	\$10.00	\$200.00	2008
Mean	\$10.30	\$210.00	
Mode	\$10.00	\$240.00	
Median	\$10.00	\$210.00	

webehigh.com

Accessed June 5th, 2010

Australian Marijuana Prices (Dollars Per Ounce) – Purchase in Grams					
year	Leaf	Heads	Leaf	Heads	
1990	747	1159	\$26.68	\$41.39	
1991	852	1168	\$30.43	\$41.71	
1992	798	1103	\$28.50	\$39.39	
1993	645	834	\$23.04	\$29.79	
1994	779	992	\$27.82	\$35.43	
1995	797	974	\$28.46	\$34.79	
1996	949	944	\$33.89	\$33.71	
1997	843	977	\$30.11	\$34.89	
1998	798	889	\$28.50	\$31.75	
1999	816	841	\$29.14	\$30.04	
Mean	802	988	\$28.64	\$35.29	
Median	798	977	\$28.50	\$34.89	

Australian Marijuana Prices (Dollars Per Ounce) – Purchase in Ounces					
year	Leaf	Heads	Leaf	Heads	
1990	390	557	\$13.93	\$19.89	
1991	381	504	\$13.61	\$18.00	
1992	313	401	\$11.18	\$14.32	
1993	326	419	\$11.64	\$14.96	
1994	341	432	\$12.18	\$15.43	
1995	350	430	\$12.50	\$15.36	
1996	339	444	\$12.11	\$15.86	
1997	320	466	\$11.43	\$16.64	
1998	344	437	\$12.29	\$15.61	
1999	322	403	\$11.50	\$14.39	
Mean	343	449	\$12.25	\$16.04	
Median	341	437	\$12.18	\$15.61	

Clemments , 2004

Marijuana Prices Hawaii			
Year	Joint	Gram	Ounce
1994	\$3-\$5	NA	\$400-\$800
1995	\$5	\$25	\$350-\$700
1996	\$5	\$25	\$350-\$700
1997	\$3-\$10	NA	\$400-\$800
1998	\$3-\$10	NA	\$400-\$800
1999	\$3-\$10	NA	\$400-\$800
2000	\$3-\$10	NA	\$400-\$800
2001	\$5-\$20	\$25	\$400-\$800
2002	\$5-\$20	NA	\$400-\$800
2003	\$5-\$20	\$25	\$400-\$800

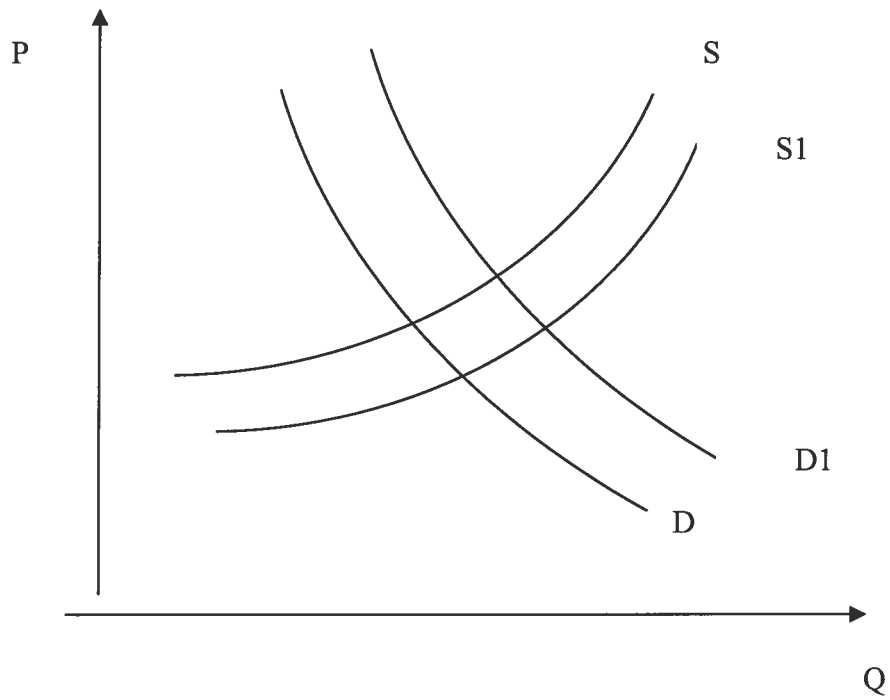
Boyd, 1999

17. Appendix – Effects of legalization on supply and demand

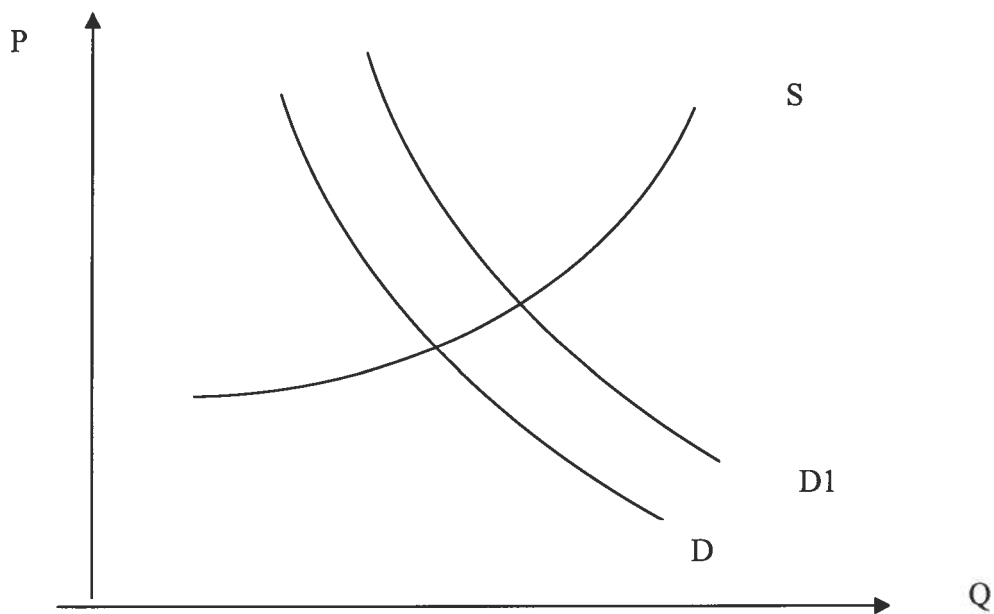
There has never been a nation that has legalized marijuana economists and policy makers are not sure what exactly will happen under legalization. This paper will outline the major possibilities of marijuana legalization.

Effect	Reason
A)Demand curve shifts up	Less risk involved in consuming, people demand more
B) Demand does not change	Less risk involved in consuming – demand shifts up, “forbidden fruit” hypothesis – demand shifts down. Ultimate effect is so marginal we can assume there is no change in demand.
C) Supply Curve Shifts up	Costs of doing business under legalization would be higher due to government regulation and control
D) No change in supply	Tax is levied which is equal to the previous risk premium
E) Supply curve shifts down	Increased number of suppliers willing to supply and the costs of doing business fall.

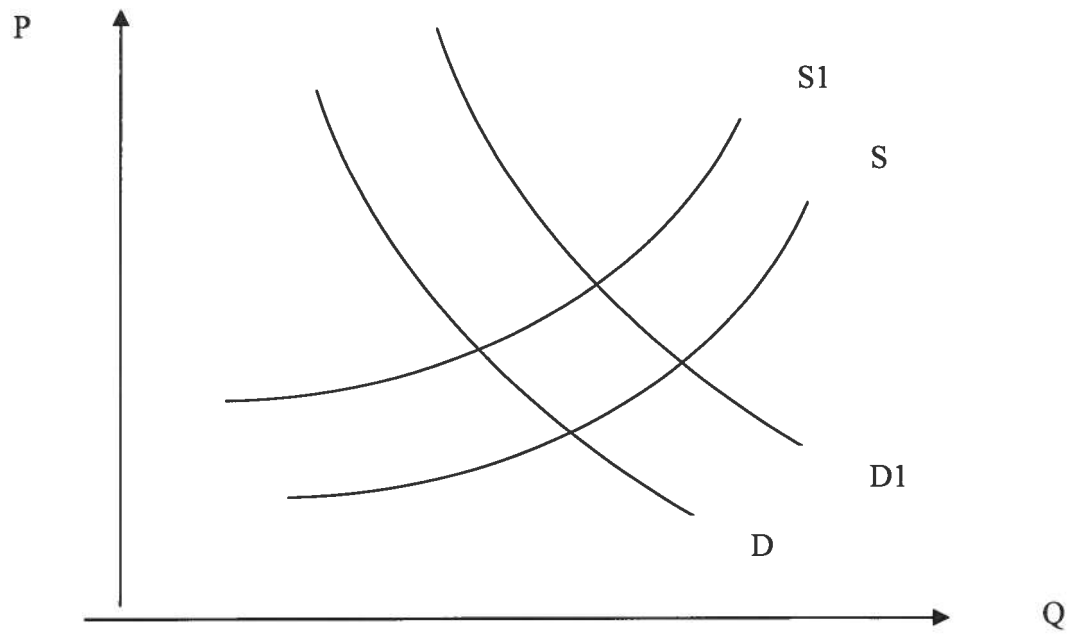
Scenario 1 A and C



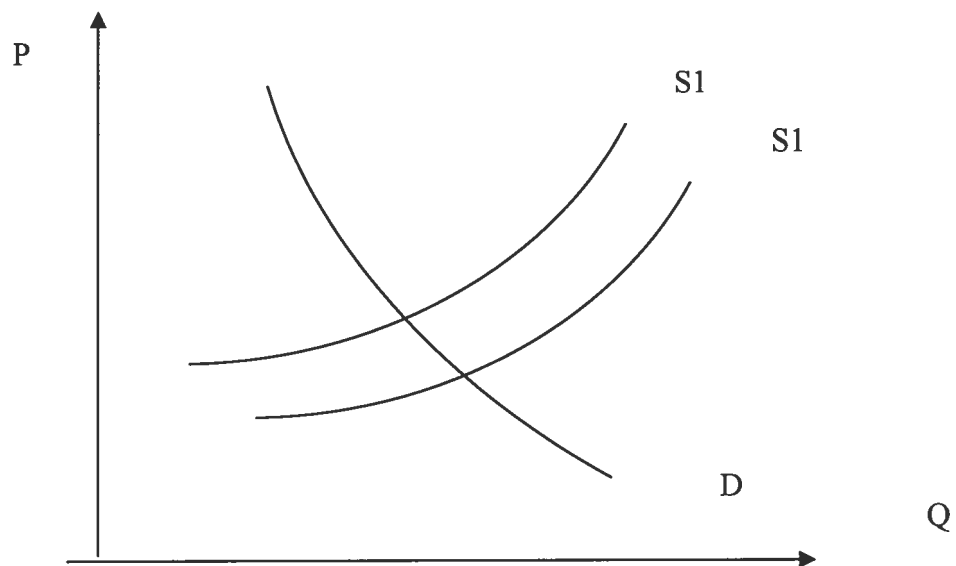
Scenario 2 A and D



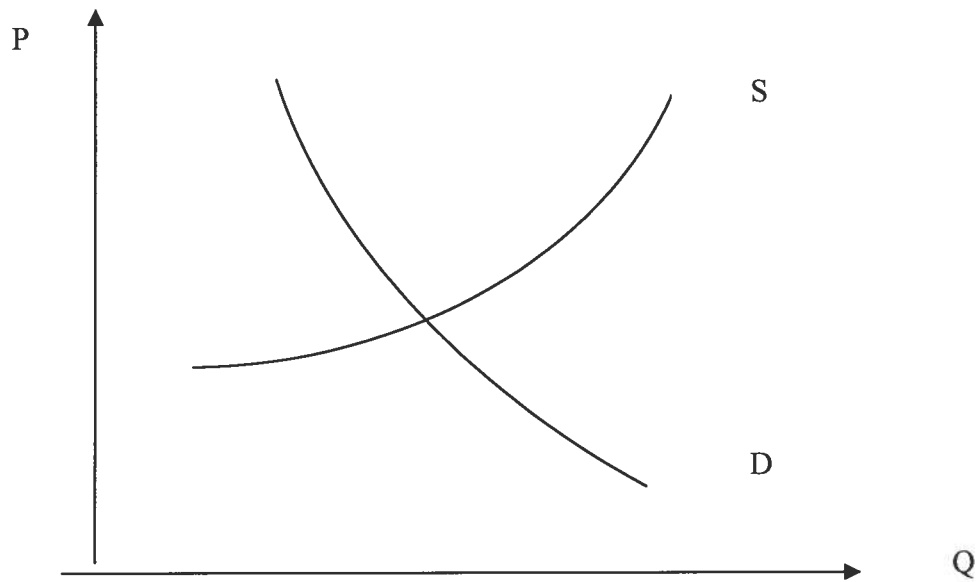
Scenario 2 A and E



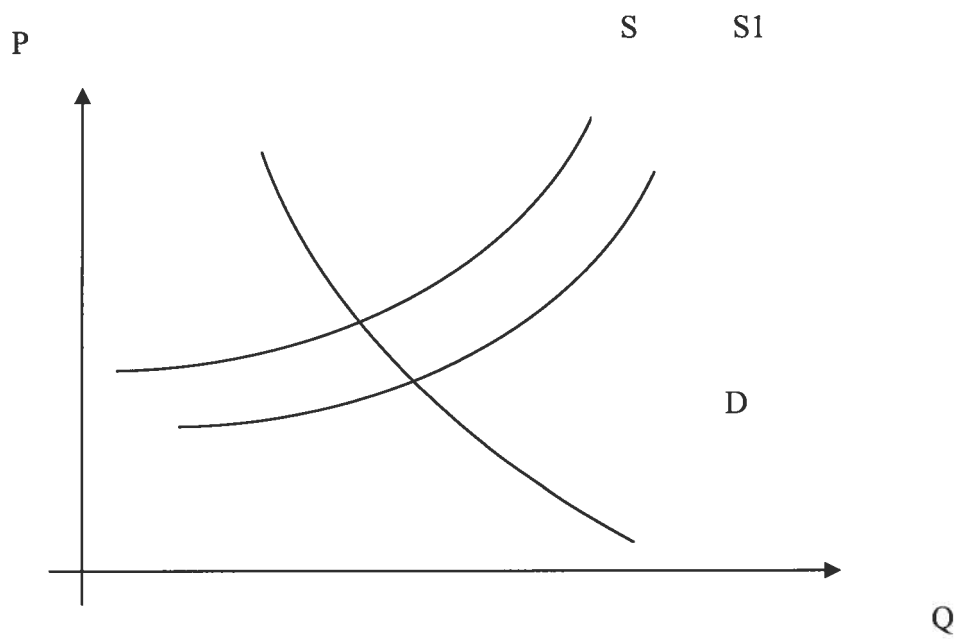
Scenario 4 B and C



Scenario 5 B and D



Scenario 6 B and E



18. Appendix – Supply Curve

There is also substantial reason to believe that this argument that prohibition will reduce supply by raising the cost of supply the drugs may not be as strong as the governments supporting prohibition wish to believe. The prohibition policy is supposed to raise prices and discourage people from using drugs. To begin, since marijuana and other illicit drugs are provided for by a black market, black market suppliers can easily evade government regulations and taxes, including employment laws, fair wages laws, pension plans, child labor laws, antitrust laws, income taxes and excise taxes. These cost savings offset some of the increased costs of prohibition.

Another reason that prohibition may have a weak effect on costs of production is that the efficacy of enforcement expenditure is possible larger for taxation and regulation polices than for prohibition. Taxes and regulations usually create both government and private organization that monitor business subject to these polices, for example, customers, consumer watchdog groups and rival firms. With prohibition there are no such third parties. Prohibition must rely on informants, sting operations and busts which all require government spending. So it is possible that the costs imposed by enforcement of a given policy are actually higher in a legal then illicit market.

A third reason that prohibition may have reticent effects on costs is the lack of ability to advertise. Advertising expenses consume a large fraction of legal organizations overhead. There is also a strong argument made by many economists that advertising is actually a waste of resources and that advertising is frequently used in ways that are harmful to society. In a free market economy when all firms are advertising, they are not

usually increasing the total demand for a particular good or service, but they are simply marginally shifting market shares between competing firms. Thus advertising has little measureable benefits and can be seen as simply a cost of doing business rather than generating profits or revenues. Competitive advertising may be mutually destructive, and that in some markets firms that engage in advertising that does little more than cancel out the advertising messages of their competitors²⁰³. Advertising is like an arms race, where firm then has a higher total costs, such that price is higher and consumption is higher. Furthermore competitive advertising can have many anti-competitive effects, for example it could deter entry and help establish monopolies. Comanor and Wilson conclude that: the weight of available evidence is consistent with the hypothesis that heavy advertising can have substantial anticompetitive consequences²⁰⁴. In prohibited markets, there is no advertising and therefore suggesting possibly higher costs of production in a legal market then in illicit market.

Finally a major factor that would affect market price is that under prohibition there are no antitrust laws, thus no regulations on market power. Most of the drugs in Eastern Ontario are controlled by the Hells Angels gang, they operate a strict monopoly on all major drug trafficking. The lack of regulation and rules is one factor that leads to the rise of monopolies in the black market for illicit drugs, the major reason is that the marginal cost of committing other crimes for those involved in drug markets is much lower than in a legal market. For example the marginal cost of using violence, to reduce competitive against other “firms” which a particular gang is competing against would be

²⁰³ Netter, 1982

²⁰⁴ Bloch, 1980

lower since drug traffickers are already evading law enforcement authorities. Furthermore the gangs have an easier time to form cartels, cause the threats are much more meaningful.

If one considers all of these arguments it is highly suggestive that one should rethink the view that necessarily prohibition will increase the cost of production and will raise prices, the issue is much more complex, and cannot be easily determined by a simple supply and demand analysis of prohibition

19. Economic Surplus

Economic surplus was derived from the original estimated demand and supply curves. From the equilibrium price, quantity and given the supply and demand functions we were able to estimate new supply and demand functions for a given percentage change in total quantity consumed. The below tables summarize the percent change in total consumption and the resulting net purchase in grams, price in grams and new demand functions for a change in consumer tastes resulting from marijuana legalization. There are 5 possible estimated increases in consumption that were measured for 2%, 4%, 8%, 10% and 15% increases in consumption. The surplus in supply was derived from each of the new demand curves and this report calculated 10 different supply scenarios, a 5%, 10%, 20%, 50% and 100% increases in total marijuana supply due to marijuana legalization.

Original Supply and Demand					
qs = 2.86			Equilibrium P	11.6	
qd = (33.17p + 1154.49)/(3p +11.6)			Equilibrium Q	33.175	
Demand Change					
% change in Qd	New Qd	New P	New Qd Function		
1.02	33.8385	11.83164336	q = (33.83p + 1201.0)/(3p +11.83)		
1.04	34.502	12.06363636	q = (34.50p + 1248.65)/(3p +12.06)		
1.08	35.829	12.52762238	q = (35.82p + 1346.57)/(3p +12.52)		
1.1	36.4925	12.75961538	q = (36.49p + 1396.88)/(3p +12.75)		
1.15	38.15125	13.3395979	q = (38.15p + 1523.76)/(3p +13.33)		

supply shifts up			
% change in Qs	new qs	new ps	new qs function
1.05	34.83375	10.5201	$q=3.31p$
1.1	36.4925	9.58	$q=3.81p$
1.2	39.81	8.032	$q=4.96p$
1.5	49.7625	4.9712	$q=10.01p$
2	66.35	2.3199	$q = 28.59913793p$

supply shifts down			
% change in Qs	new qs	new ps	new qs function
0.05	31.51625	12.849943	$q=2.4526379111p$
0.1	29.8575	14.325722	$q=2.0841884387p$
0.2	26.54	18.22660926	$1.4561127933p$
0.5	16.5875	57.98252222	$q = 0.2860776959p$

Current Function		Intercepts		Surplus
$qs = 2.86$		300	0	2801.99
$qd = (33.17p + 1154.49)/(3p + 11.6)$		0	99.525	

The following table highlights all of the newly derived supply and demand functions for a given change in supply, these are labeled a,b,c,d,e for each of the respective changes in total consumption and 1,2,3,4,5,6,7,8,9,10 for each of the possible increases or decreases in supply.

	New Demand Function		% change
a	$q = (33.83p + 1201.0)/(3p + 11.83)$		1.02
b	$q = (34.50p + 1248.65)/(3p + 12.06)$		1.04
c	$q = (35.82p + 1346.57)/(3p + 12.52)$		1.08
d	$q = (36.49p + 1396.88)/(3p + 12.75)$		1.1
e	$q = (38.15p + 1523.76)/(3p + 13.33)$		1.15
	New Supply Function (Shift up)		
1	$3.31p$		1.05
2	$3.81p$		1.1

3	4.96p			1.2
4	10.01p			1.5
5	28.59913793p			2
	New Supply Function (Shift down)			
6	2.4526379111p			1.05
7	2.0841884387p			1.1
8	1.4561127933p			1.2
9	0.2860776959p			1.5
10	0			2

The following table shows each of the 50 possible combinations of shifts in supply and demand, the new resulting equilibrium price, new equilibrium quantity, the total percent change in total consumption and the resulting new change in total economic surplus. The last row of each of the tables is 0 because no equilibrium exists, in that production costs were pushed too high in order for suppliers to stay in business.

	New Price	New Quantity	% Change in Q	Change in Surplus
a1	10.73	35.51	0.070384326	1636398749
a2	9.77	37.22	0.121929164	1752376689
a3	8.19	40.62	0.224415976	1955436941
a4	5.07	50.75	0.52976639	2424868957
a5	2.37	67.77	1.042803316	2971295143
a6	13.11	32.6	-0.017332329	1347147695
a7	14.61	30.38	-0.084250188	1207948345
a8	18.59	26.95	-0.187641296	811830962.9
a9	59.14	16.91	-0.490278824	-2533638717
a10	0	0	0	0

b1	10.94	36.21	0.091484552	1829956645
b2	9.96	37.94	0.143632253	1951190988

b3	8.35	41.41	0.248229088	2162042093
b4	5.17	51.75	0.55990957	2649672499
b5	2.41	68.92	1.077467973	3221400130
b6	13.37	32.75	-0.012810852	1548376800
b7	14.49	30.13	-0.091785983	1483501237
b8	18.96	27.49	-0.171363979	971134371.5
b9	60.3	17.24	-0.480331575	-2506319181
b10	0	0	0	0

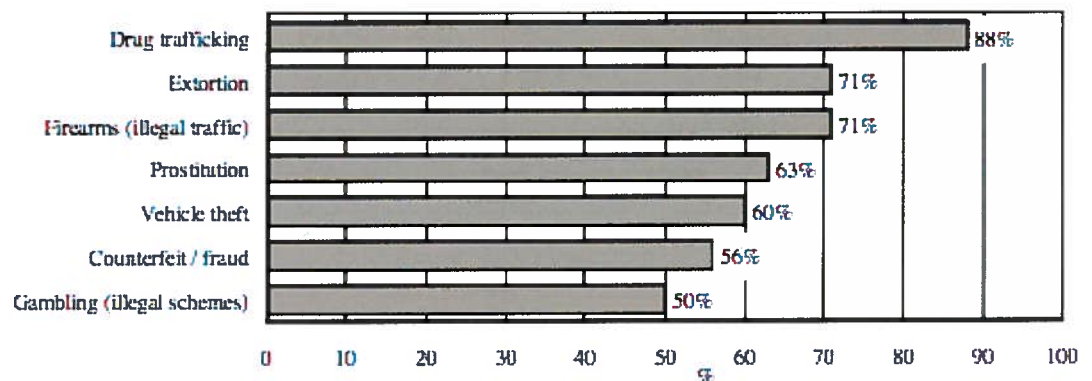
c1	11.37	37.63	0.134287867	2195319558
c2	10.35	39.43	0.188545592	2326401139
c3	8.67	43	0.296156745	2556360659
c4	5.37	53.75	0.620195931	3081480867
c5	2.51	71.76	1.163074604	3694682542
c6	13.88	34	0.024868124	1895384544
c7	15.47	37.9	0.142426526	1451369405
c8	19.69	28.55	-0.139412208	1271527102
c9	62.62	17.53	-0.471590053	-2408060411
c10	0	0	0	0

d1	11.58	38.32	0.155086662	2378513859
d2	10.54	40.15	0.210248681	2514795751
d3	8.83	43.79	0.319969857	2752985380
d4	5.47	54.75	0.650339111	3297227179
d5	2.55	72.9	1.19743783	3937185524
d6	14.14	34.64	0.044159759	2066090933
d7	15.76	32.78	-0.011906556	1881052726
d8	20.05	29.07	-0.123737754	1421074275
d9	63.78	18.24	-0.450188395	-2470878353
d10	0	0	0	0

e1	12.09	40	0.205727204	2842488691
e2	11.01	41.94	0.264204974	2989123172
e3	9.22	45.73	0.378447626	3250538740
e4	5.71	57.61	0.736548606	3837958420
e5	2.67	76.33	1.300828937	4539785154
e6	14.77	36.18	0.090580256	2499168921
e7	16.46	34.23	0.031801055	2297760223
e8	20.94	30.36	-0.084853052	1795236183
e9	66.65	18.66	-0.437528259	-2380099624
e10	0	0	0	0

20. Organized Crime

Figure 1
Crimes Most Frequently Committed by Organized Crime Groups in Canada



Source: Canadian Centre for Justice Statistics.

Source: Sauve, Julie. "Organized Crime Activity in Canada, 1998: Results of a "Pilot" Survey of 16 Police Services. Department of Justice Canada. Canadian Centre for Justice Statistics. 1999

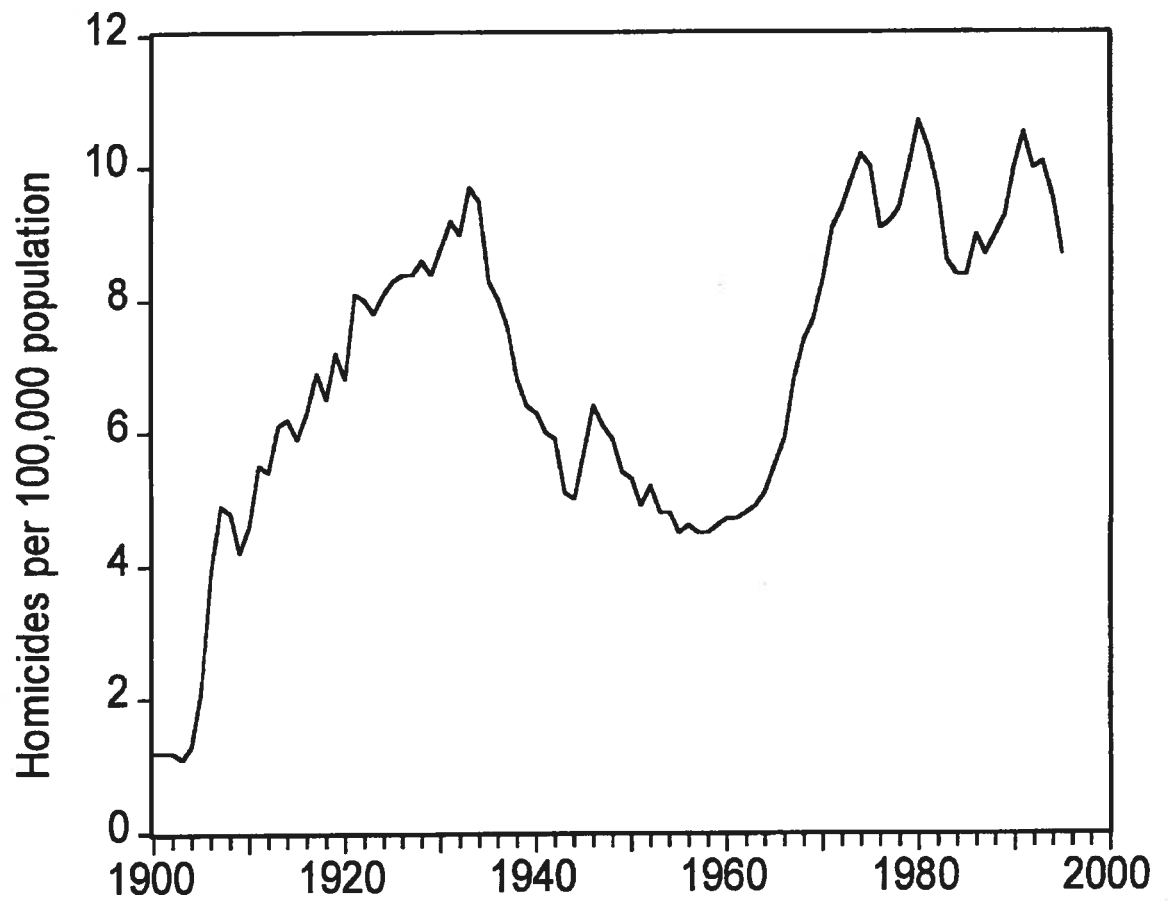


Figure 1: Homicide Rate in the United States

Figure 2:

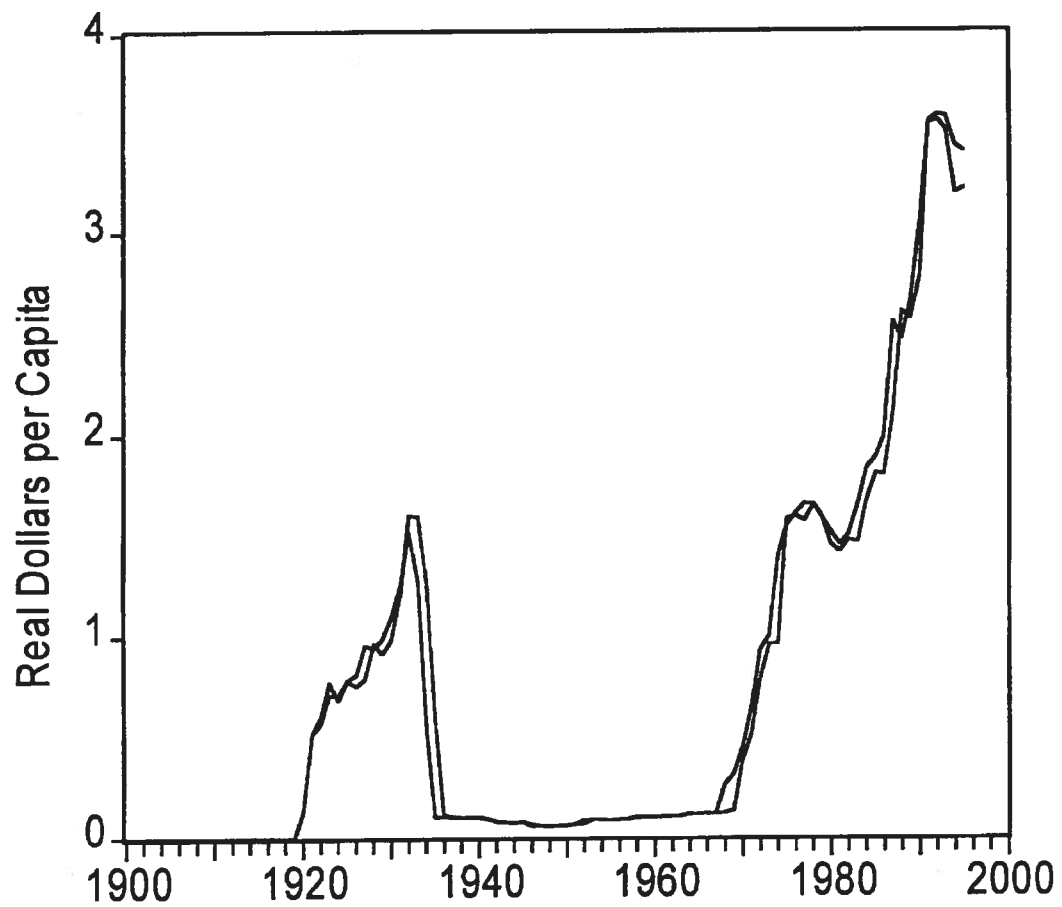


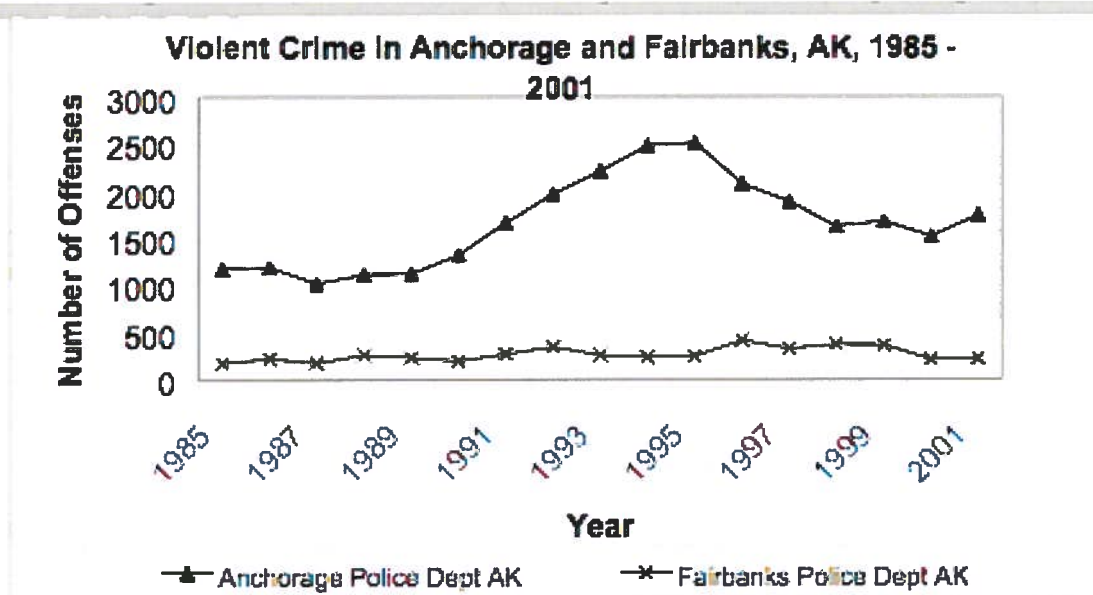
Figure 2: Expenditure for Enforcement of Alcohol and Drug Prohibition

Figure 3

Table 4: Regressions of the Homicide Rate on Prohibition Enforcement

	1900-95	1900-95	1900-95	1930-95	1930-95	1925-95	1925-95	1930-95
Enforcement	101.9 (3.78)	100.9 (3.56)	102.1 (3.78)	162.6 (5.19)	152.2 (4.50)	154.9 (5.71)	150.6 (7.15)	141.1 (4.02)
Unemployment Rate		0.01 (0.31)						0.02 (0.31)
Per Capita Income			37.2 (0.41)					3.87 (0.02)
Execution Rate					-47.2 (0.96)			-51.0 (0.92)
Incarceration Rate							-0.03 (3.36)	-0.03 (3.22)
R^2	.95	.95	.95	.94	.94	.94	.95	.95
Impact	3.6	3.6	3.7	5.8	5.4	5.6	5.3	5.0

1. Newey and West (1987) t-statistics in parentheses; constant and trend term included in all regressions.
2. Fraction of the population in each of seven age categories included in all regressions; see text for details.



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