



Public Safety Canada

The Price of Marijuana in Canada:
Preliminary Discussion of Using Price Data
for Operational and Policy Purposes

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**The Price of Marijuana in Canada:
Preliminary Discussion of Using Price Data
for Operational and Policy Purposes**

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*The views expressed herein are those of the authors and
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Background

The fight against illegal drugs is a priority of the current government. In 2007, the Government of Canada has committed roughly \$232 million in funding over five years to establish and implement the National Anti-Drug Strategy (NADS) (NADS, 2012a, 2012b, 2012c). Led by the Department of Justice, NADS is a “horizontal initiative of 12 federal departments and agencies” across the government (Department of Justice, 2012), and funded by the Department of Justice, Health Canada and Public Safety Canada (NADS, 2012). This strategy “focuses on prevention and access to treatment for those with drug dependencies, while at the same time getting tough on drug dealers and producers who threaten the safety of our youth and communities” (NADS, 2012; Department of Justice, 2012). NADS have three major courses of actions:

- 1) prevention, for \$30 million of the total investment;
- 2) treatment; for \$100 million of the total investment; and
- 3) enforcement, for \$102 of the total investment (NADS, 2012a, 2012b, 2012c).

First, the prevention action plan aim at preventing illicit drug use among youth by providing detailed information to those involved and/or affected by drug consumption (NADS, 2012a). Then, the treatment action plan “supports innovative and effective approaches to treating and rehabilitating those with illicit drug addiction who pose a risk to themselves and the community” (NADS, 2012b). Finally, the enforcement action plan strengthens law enforcement ability to “investigate and prosecute drug crimes,” but also to “combat marihuana grow operations and synthetic drug production and distribution operations” (NADS, 2012c).

With the election of a Conservative majority government in 2011, the political program to combat drug related crime was strengthened with legislation and policy that strengthened correctional sanctions for those convicted of such crimes. The *Safe Streets and Communities Act* came into effect in March 2012 (i.e. *Omnibus Crime Bill C10*). This Act now provides judge with the ability to impose harsher sentences for those convicted of drug related crimes under the *Controlled Drugs and Substances Act*. As an example, marijuana growers may be required to serve a mandatory minimum sentence if they had exceeded a certain numbers of marijuana plants.

A recent study on the price of illicit drugs as an outcome measure of enforcement effectiveness highlighted that the basic goal of drug law enforcement and drug policies is to reduce drug supply (Bright and Ritter, 2010). Thus, to decrease drug consumption, drug-related crimes, violence and societal problems enhanced by drugs, drug prices should be increased, as well as the degree of difficulty in obtaining it (Bright and Ritter, 2010). In short, the role of law enforcement in anti-drug policy is basically to decrease the supply of drugs as to “sufficiently [...] drive up price, making drug use less attractive” (Bright and Ritter, 2010: 359).

Law enforcement can impact drug prices in two different ways. On the one hand, “temporary disruption” of drug market by law enforcement creates supply insufficiencies which increase drug price (Bright and Ritter, 2010: 360). On the other hand, tactical and operational law enforcement activities increase the cost of drug production and transportation which in turn cause

“manufacturers and dealers [...] to pass on [these] costs to consumers through increased [retail] prices” (Bright and Ritter, 2010: 360).

Empirical evidence had showed that the utilization of drug retail price as an outcome measure of policing effectiveness depends on three mechanisms:

- 1) “the ability of law enforcement interventions to disrupt supply or to increase production/distribution costs;
- 2) the impact of supply disruption and/or costs increases on retail price; and
- 3) the sensitivity of consumers to retail price changes (i.e., price elasticity of demand)” (Bright and Ritter, 2010: 360).

The price elasticity of demand measures the “percentage change in consumption induced by a 1% increase in price,” and Caulking and Lee (2012) present five types of price elasticity of demand (40). An elastic price of demand is “when consumption responds to price fluctuations more than proportionately”. Inelastic is when it responds “less than proportionately,” and perfectly inelastic is when consuming will stay the same independently of price changes (Caulking and Lee, 2012: 40). In addition, participation elasticity “measures the number of consumers,” and conditional elasticity “measures the change in the number of incidents of usage” (Caulking and Lee, 2012: 40). Each of these price elasticities can be used to evaluate the state of drug markets and, hence, the efforts to modify or suppress the markets.

Objective

The purpose of this preliminary discussion paper is to explore the possibility of using the price information of marijuana to determine characteristics of the commodity market that might be useful for tactical operational planning, policy development, or performance measurement. The paper describes a publicly available, self-reported data set on marijuana prices in Canada, discusses some research possibilities, and describes possible next steps in research.

Approach

The *Price of Weed* data set was downloaded and cleaned using a number of logical assumptions informed by the economic and criminological literature. Descriptive statistics were generated to determine some basic information about the trends in marijuana price information in the dataset:

- a) What is the mean and median price per gram, by province?
- b) What is the number of reports, by province?
- c) What is the mean and median price per gram, by city?
- d) What is the number of reports, by city?
- e) What is the mean and median price per gram, by reporting month?
- f) What is the number of reports, by month?

The descriptive statistics were examined and ideas for future research elaborated.

Data Set, “The Price of Weed”

In order to explore the possible utility of using marijuana price data to inform operational and policy goals, a primary data source on the price of marijuana was required. As it happens, the *Price of Weed* website - <http://www.priceofweed.com/> - makes such data freely available to the public. The data is generated from a public, online survey website that anonymously crowdsources the street value of marijuana from the most accurate source possible: the consumers (Price of Weed, 2012). Studies show that there is an underreporting of approximately 10-40% amongst marijuana users, particularly youth. Thus, the use of alternative sources of data on marijuana are important to explore in order to augment consumption surveys which have historically been used as the basis for discussing the size and nature of the marijuana market in Canada. Said to be a “global price index for marijuana,” this self-reported price of marijuana website has records all over the globe (Price of Weed, 2012). For this project, it will be used to generate descriptive data on the estimate average price of marijuana in Canada.

Procedure Used to Clean the Data Set

The *Price of Weed* data come from an online survey website that anonymously crowdsources the street value of marijuana from the most accurate source possible: the consumers (Price of Weed, 2012). Said to be a “global price index for marijuana”, this self-reported price of marijuana website has records all over the globe (Price of Weed, 2012). As for Canada, it records data since September 2010.

The extracted data set – the Price of Marijuana in Canada (RDIMS 721894) – has been last updated on November 9, 2012, at 10:20am (Eastern Time). Extraction started at 8:05am on November 9, 2012, and finished at 10:20am on November 9, 2012. After the extraction, 5,846 records were found in the data set which is the same number of records that were found on the website before the extraction started.

The extracted data was sorted into five variables, namely:

- 1) City / Province: this variable was exclusively self-reported by the individual.
- 2) Price: the variable is exclusively self-reported by the individual. Note that any values that is \$1,001 and over cannot be submitted on the website.
- 3) Quantity: The quantity values were predetermined (i.e. an ounce; a half ounce; a quarter; an eighth; 10 grams; 5 grams; 1 gram) and exclusively selected by the individual.
- 4) Quality: The quality values were predetermined (i.e. high quality; medium quality; low quality) and exclusively selected by the individual. The medium quality is the auto-fill option offered by the website.
- 5) Date: The date is automatically recorded by the website upon submission.

Once all the data was extracted in MS Excel, the 1st variable (City / Province) was divided in two variables using “Text to Columns” function in the “Data – Data Tools” tabular in MS Excel.

If an ounce equals to 28.4 grams (i.e. 28.3495), the variable “price (gram)” was created as follow:

- an ounce: the price was divided by 28.4
- a half ounce: the price was divided by 14.2
- a quarter: the price was divided by 7.1
- an eighth: the price was divided by 3.55
- 10 grams: the price was divided by 10
- 5 grams: the price was divided by 5
- 1 gram: the price was divided by 1

Here are the variables in the price of weed data set:

- Province; City; Price; Quantity; Price (in grams); Quality; Date.

A new variable was created: “Date (m/y)” so that the number of reports by months can be calculated, as well as the mean and median price (per gram) by months.

- Variable “Date” = dd/mm/yyyy
- Variable “Date (m/y)” = mm/yyyy

Here are the variables in the price of weed data set:

- Province; City; Price; Quantity; Price (in grams); Date; Date (m/y).

In estimating the retail price of illegal drugs, the literature states that “gifts” do have an impact in estimating the retail expenditures of illegal drugs, such as marijuana (Werb, Nosyk, Kerr, Fischer, Montaner and Wood, 2012: 437). The literature also points out that individuals who do not consume marijuana on a regular basis may have to pay little, if at all, for their drugs since they receive them as a gift (Werb and al., 2012: 437). While the website blocks all entries that had left the price box empty (i.e. no values were entered in the price box), we assume that individual who reported a value of \$0 may have received free marijuana as a gift, were just kidding around, or were testing how to fill out the form on the website. While it could affect the estimates of the marijuana retail price, we suggest excluding all records that have a value of \$0 for any quantity of marijuana that was self-reported by crowdsourcing. Here are all those excluded records:

Ontario	Kitchener	\$0	an ounce	\$0.00	high quality	10/10/2012	10/2012
British Columbia	Nanaimo	\$0	an eighth	\$0.00	high quality	10/10/2012	10/2012
British Columbia	Courtenay	\$0	an ounce	\$0.00	medium quality	09/10/2012	10/2012
Ontario	Simcoe	\$0	an ounce	\$0.00	medium quality	17/08/2012	8/2012
Ontario	Lindsay	\$0	an ounce	\$0.00	medium quality	25/06/2012	6/2012
British Columbia	Victoria	\$0	5 grams	\$0	low quality	05/06/2012	6/2012
Ontario	Glencoe	\$0	5 grams	\$0	medium quality	30/04/2012	4/2012
Ontario	Toronto	\$0	a quarter	\$0.00	high quality	25/03/2012	3/2012
Alberta	Acme	\$0	an ounce	\$0.00	high quality	14/01/2012	1/2012
Alberta	Calgary	\$0	an ounce	\$0.00	high quality	29/10/2011	10/2011
British Columbia	Qualicum Beach	\$0	an ounce	\$0.00	low quality	01/03/2011	3/2011
Nova Scotia	Westville	\$0	an ounce	\$0.00	medium quality	12/02/2011	2/2011
British Columbia	Campbell River	\$0	an ounce	\$0.00	medium quality	16/09/2010	9/2010
Ontario	Mississauga	\$0	an eighth	\$0.00	high quality	15/09/2010	9/2010

Furthermore, the literature indicates that marijuana is usually selling from “\$140 - \$1,000 per ounce, depending on the quality” (Caulkins and Reuter, 1998: 594). More importantly, the website does not allow any form of submission that have a price over \$1,000 (i.e. \$1,001 and more). Thus, for any quantity of marijuana reported not by ounce, we suggest excluding every records that have an exact price of \$1,000 because they are exaggerated values (i.e. outliers). Here are all those excluded records:

Ontario	Kitchener	\$1,000	a quarter	\$140.85	high quality	29/10/2012	10/2012
British Columbia	Burnaby	\$1,000	a half ounce	\$70.42	high quality	13/09/2012	9/2012
Ontario	Ottawa	\$1,000	a gram	\$1,000	high quality	31/08/2012	8/2012
British Columbia	Powell River	\$1,000	5 grams	\$200	low quality	22/07/2012	7/2012
Ontario	Waterdown	\$1,000	10 grams	\$100	high quality	04/07/2012	7/2012
Ontario	Brantford	\$1,000	5 grams	\$200	medium quality	30/04/2012	4/2012
Ontario	Orangeville	\$1,000	a quarter	\$140.85	medium quality	17/04/2012	4/2012
Quebec	Montreal	\$1,000	an eighth	\$281.69	low quality	29/04/2011	4/2011
Ontario	Saint Catharines	\$1,000	a half ounce	\$70.42	high quality	03/01/2011	1/2011

In connection with the foregoing exclusions, and taking into account the fact that prices vary with the quality of marijuana itself and that the higher estimated price of marijuana is \$1,000 (Caulkins and Reuter, 1998), we assume that this price is therefore attributable to high quality marijuana. We suggest excluding each record that has a price value of a \$1,000 that were described as other than high quality marijuana (i.e. low quality and medium quality). Here are all those excluded records:

Ontario	Sarnia	\$1,000	an ounce	\$35.21	medium quality	27/06/2012	6/2012
Alberta	Calgary	\$1,000	an ounce	\$35.21	medium quality	28/05/2012	5/2012
British Columbia	Abbotsford	\$1,000	an ounce	\$35.21	low quality	22/04/2012	4/2012
Ontario	Burlington	\$1,000	an ounce	\$35.21	low quality	22/03/2012	3/2012
Newfoundland and Labrador	Bay Roberts	\$1,000	an ounce	\$35.21	low quality	22/11/2010	11/2010
Ontario	Kitchener	\$1,000	an ounce	\$35.21	low quality	15/09/2010	9/2010

We also suggest excluding every record that has a price value of three consecutive identical digits (i.e. \$666, \$555, etc.). We assume that anyone who entered those values were just testing how to fill out the form or joking around. Here are all those records that we have excluded:

Newfoundland and Labrador	Saint John's	\$999	an ounce	\$35.18	medium quality	18/09/2012	9/2012
New Brunswick	Memramcook	\$999	5 grams	\$200	low quality	30/05/2012	5/2012
Quebec	Amqui	\$999	5 grams	\$200	low quality	11/03/2012	3/2012
Ontario	Kitchener	\$555	an eighth	\$156.34	medium quality	23/06/2012	6/2012

Since our assumption that the maximum worth of a high quality ounce of marijuana is \$1,000, which means \$35.21 per grams, we can easily justify excluding every quantity of marijuana – other than in ounces – that exceeds this maximum price per gram. By doing so, we eliminate some of the price outliers that could have greatly inflate (i.e. bias) our estimates. Note that none of the self-reported quantity in “a gram” was observed to be over the price of \$20 in the data set. Other than the quantities reported in “a gram”, here are all those records that we have excluded:

Yukon Territory	Lansdowne	\$900	an eighth	\$253.52	low quality	02/04/2011	4/2011
Yukon Territory	Lansdowne	\$784	an eighth	\$220.85	low quality	27/02/2011	2/2011
Quebec	Montreal	\$400	an eighth	\$112.68	low quality	17/05/2011	5/2011
Quebec	Montreal	\$220	an eighth	\$61.97	high quality	04/09/2011	9/2011

Ontario	Flesherton	\$700	a quarter	\$98.59	high quality	27/10/2012	10/2012
Ontario	Oshawa	\$600	a quarter	\$84.51	medium quality	15/04/2012	4/2012
Quebec	Chandler	\$500	a quarter	\$70.42	medium quality	29/06/2011	6/2011
Quebec	Chandler	\$450	a quarter	\$63.38	medium quality	26/10/2011	10/2011
Ontario	Toronto	\$450	a quarter	\$63.38	high quality	28/03/2011	3/2011
Quebec	Quebec	\$400	a quarter	\$56.34	medium quality	22/06/2011	6/2011
British Columbia	Victoria	\$300	a quarter	\$42.25	medium quality	08/03/2012	3/2012
Ontario	Wawa	\$800	a half ounce	\$56.34	low quality	30/06/2012	6/2012
British Columbia	Victoria	\$900	5 grams	\$180	medium quality	21/06/2012	6/2012
Ontario	Oshawa	\$900	5 grams	\$180	low quality	15/08/2011	8/2011
British Columbia	Vancouver	\$800	5 grams	\$160	medium quality	17/04/2012	4/2012
Saskatchewan	Regina	\$800	5 grams	\$160	low quality	04/03/2011	3/2011
British Columbia	Vancouver	\$700	5 grams	\$140	low quality	13/07/2012	7/2012
British Columbia	Surrey	\$652	5 grams	\$130	low quality	23/09/2010	9/2010
Ontario	Orillia	\$500	5 grams	\$100	high quality	30/10/2012	10/2012
Ontario	Ottawa	\$400	5 grams	\$80	low quality	26/05/2012	5/2012
Nunavut	Baker Lake	\$250	5 grams	\$50	high quality	16/11/2010	11/2010
Nunavut	Baker Lake	\$250	5 grams	\$50	high quality	21/09/2010	9/2010
Nunavut	Baker Lake	\$250	5 grams	\$50	high quality	16/09/2010	9/2010
Ontario	Brampton	\$200	5 grams	\$40	high quality	20/12/2011	12/2011
Ontario	Sudbury	\$500	10 grams	\$50.00	low quality	17/05/2012	5/2012
Alberta	Bonnyville	\$500	10 grams	\$50.00	high quality	30/03/2012	3/2012

Also, we think that many visitors that had filled the form on the website may have accidentally filled out the price for “an ounce” when they meant gram, or else because this is the auto-fill option offered by the website. With the average price per gram for people who reported in a way not by ounce, we then excluded all ounces which have a total price that ends up being below the average price per gram. The average price per gram for those who did not report in a way by ounce is \$8.35. Here are the records of ounces that had a total price under the above-average of \$8.35 that were excluded:

Quebec	Cowansville	\$5	an ounce	\$0.18	medium quality	09/11/2012	11/2012
Nova Scotia	Dartmouth	\$5	an ounce	\$0.18	medium quality	04/09/2012	9/2012
Ontario	London	\$5	an ounce	\$0.18	medium quality	15/08/2012	8/2012
Alberta	Tofield	\$5	an ounce	\$0.18	low quality	07/08/2012	8/2012
British Columbia	Powell River	\$5	an ounce	\$0.18	high quality	22/07/2012	7/2012
British Columbia	Surrey	\$5	an ounce	\$0.18	medium quality	18/07/2012	7/2012
Ontario	Ottawa	\$5	an ounce	\$0.18	medium quality	17/07/2012	7/2012
Ontario	Markham	\$5	an ounce	\$0.18	high quality	18/06/2012	6/2012
Ontario	Kenora	\$5	an ounce	\$0.18	medium quality	29/04/2012	4/2012
Quebec	Montreal	\$5	an ounce	\$0.18	high quality	04/04/2012	4/2012
Ontario	Windsor	\$5	an ounce	\$0.18	medium quality	03/02/2012	2/2012
Alberta	Milk River	\$5	an ounce	\$0.18	high quality	28/01/2012	1/2012
British Columbia	Surrey	\$5	an ounce	\$0.18	low quality	25/01/2012	1/2012
Ontario	Toronto	\$5	an ounce	\$0.18	medium quality	23/01/2012	1/2012
Ontario	Beachburg	\$5	an ounce	\$0.18	medium quality	15/01/2012	1/2012
Ontario	Ottawa	\$5	an ounce	\$0.18	high quality	06/04/2011	4/2011
Quebec	Montreal	\$5	an ounce	\$0.18	medium quality	26/09/2010	9/2010
Ontario	New Liskeard	\$4	an ounce	\$0.14	high quality	16/02/2011	2/2011
Ontario	Oshawa	\$4	an ounce	\$0.14	high quality	30/09/2010	9/2010
British Columbia	Vancouver	\$2	an ounce	\$0.07	high quality	31/08/2012	8/2012
Ontario	Ottawa	\$2	an ounce	\$0.07	high quality	19/01/2012	1/2012
Ontario	Brampton	\$2	an ounce	\$0.07	high quality	21/10/2011	10/2011
Ontario	Windsor	\$2	an ounce	\$0.07	high quality	19/08/2011	8/2011
Manitoba	Winnipeg	\$2	an ounce	\$0.07	high quality	13/06/2011	6/2011
Ontario	Orleans	\$1	an ounce	\$0.04	medium quality	21/10/2012	10/2012
Ontario	Toronto	\$1	an ounce	\$0.04	medium quality	19/08/2012	8/2012
Ontario	Toronto	\$1	an ounce	\$0.04	medium quality	25/07/2012	7/2012
Ontario	Toronto	\$1	an ounce	\$0.04	medium quality	16/06/2012	6/2012
Ontario	Toronto	\$1	an ounce	\$0.04	high quality	14/06/2012	6/2012
New Brunswick	Quispamsis	\$1	an ounce	\$0.04	high quality	30/05/2012	5/2012
Ontario	Dundas	\$1	an ounce	\$0.04	medium quality	31/12/2011	12/2011
Ontario	Ottawa	\$1	an ounce	\$0.04	high quality	13/12/2011	12/2011
Ontario	Toronto	\$1	an ounce	\$0.04	medium quality	12/12/2011	12/2011
Quebec	Montreal	\$1	an ounce	\$0.04	medium quality	25/01/2011	1/2011
Quebec	Mirabel	\$1	an ounce	\$0.04	high quality	07/01/2011	1/2011

Initially, the data set had 5,846 records. If we subtract from that number the 94 records that were excluded through the foregoing discussions, we are left with 5,752 records. That number matches the number of records in the price of marijuana data set. Thus, we did not want to eliminate all outliers, some pay a low amount of money for marijuana, while others may pay an excessive price.

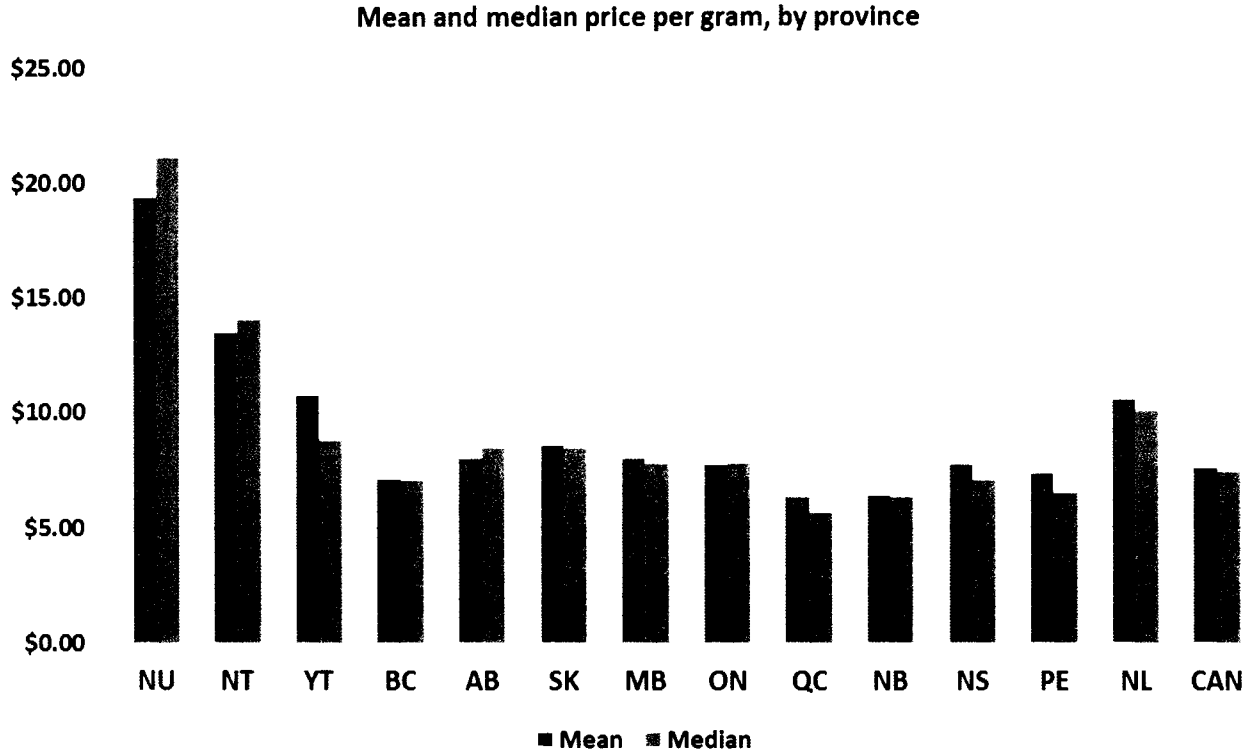
Descriptive Statistics Drawn from “The Price of Weed”

Cost of Marijuana, by Province and Territory

The following graph shows that the price of marijuana is evenly divided around the mean. In Canada, the mean price of marijuana is \$7.54 and the median is \$7.39. Compared to the provinces, the price of marijuana is generally higher in the territories. In addition, marijuana prices in Newfoundland and Labrador seems to be significantly higher than in other provinces. These price differentials may be indicative of higher costs of transportation to remote locations, where there are lower levels of local production, but still strong demand.

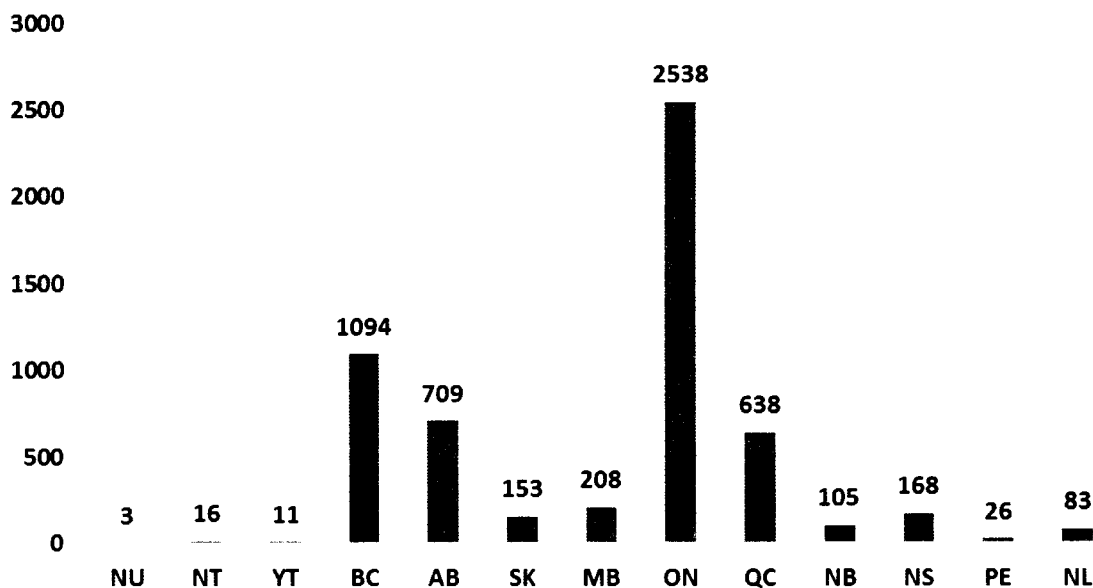
Generally, lower prices for marijuana may indicate a situation conducive to an export market, since supply outweighs the demand, while higher prices may indicate a situation conducive to an

import market. Thus, British Columbia, Quebec and New Brunswick may have a larger fraction of their production being exported from the province than Alberta, Saskatchewan, Manitoba, Ontario, Nova Scotia and Prince Edward Island; while the Territories and Newfoundland and Labrador are more likely to meet more of their demand through imports.



The following chart illustrates the number of reports recorded for each provinces and territories. While Ontario is the province with the most number of reports for the price of marijuana, respectively followed by British Columbia, Alberta and Québec, the territories are those with the lowest number of recorded reports, with Nunavut having the least. Reporting rates basically reflect the population distribution of Canada.

Number of report, by province



	Mean \$ gram	Median \$ gram	Frequency
NU	\$19.39	\$21.13	3
NT	\$13.49	\$14.08	16
YT	\$10.77	\$8.80	11
BC	\$7.10	\$7.04	1,094
AB	\$7.98	\$8.45	709
SK	\$8.54	\$8.45	153
MB	\$8.01	\$7.75	208
ON	\$7.70	\$7.75	2,538
QC	\$6.29	\$5.63	638
NB	\$6.38	\$6.34	105
NS	\$7.71	\$7.04	168
PE	\$7.35	\$6.51	26
NL	\$10.55	\$10.00	83
CAN	\$7.54	\$7.39	5,752

Cost of Marijuana, by Municipality

There are 527 different cities across Canada represented in the *Price of Weed* data set. The city that had the most reports was Toronto (610), respectively followed by Montréal (337), Vancouver (309) and Calgary (306). In terms of prices, Toronto is also the city where the price of marijuana seems higher with a value of \$8.41 per gram, respectively followed by Calgary (\$8.18/g), Vancouver (\$7.56/g) and Montréal (\$6.78/g).

The number of reports for certain cities is low, so the statistical reliability of the data for most cities is suspect; creative grouping and a combination of descriptive statistics and qualitative analysis may need to be used in future research.

Cost of Marijuana, over Time

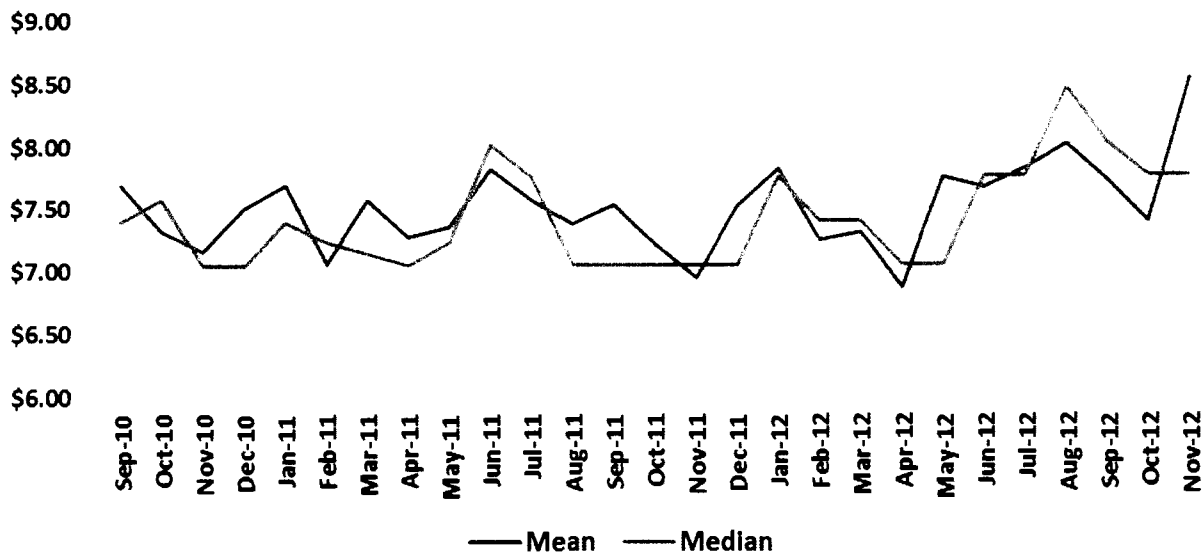
This next graph illustrates, since the debut of data collection on the *Price of Weed* website in September 2010, the mean and median price of marijuana over the 27 month period where the price of marijuana was recorded on the website. Once again, the price of marijuana is evenly divided around the mean. The lowest mean is in April 2012 with a value of \$6.86 per gram, and the highest mean recorded is in November 2012 with a value of \$8.52 per gram.

There appears to be a rough price spike around mid-winter declining into the spring, a price spike again at the start of the summer declining in the fall. It is not clear why these price fluctuations occur, more research will be required. Marijuana can be cultivated on a rough 18 to 20 week schedule (from planting to prepared product for sale). Thus, per year, the Canadian climate only allows for approximately one marijuana crops to be grown outdoors, but approximately three marijuana crops to be grown indoors. A price spike in summer and a decline in the fall might be explained by a restriction in supply at the start of the outdoor growing season and some increase in supply due to outdoor summer production being released into the market. Further, while research on seasonal consumption of marijuana is lacking, anecdotal evidence suggests that consumption of the drug might be higher in summer due to outdoor festivals and other social activities. Thus, a spike in the price of marijuana in summer could be explained by higher demand and restricted supply.

However, a price spike in mid-winter with declines into the spring is more difficult to explain. It is expected that indoor marijuana growers can produce multiple crops per year, evening out price fluctuations. This data may indicate additional indoor producers starting growing, or indoor producers expanding production, or outdoor growers moving indoors in the fall. In any of these cases, additional production coming on-line in the late fall and early winter may result in lower prices in the spring.

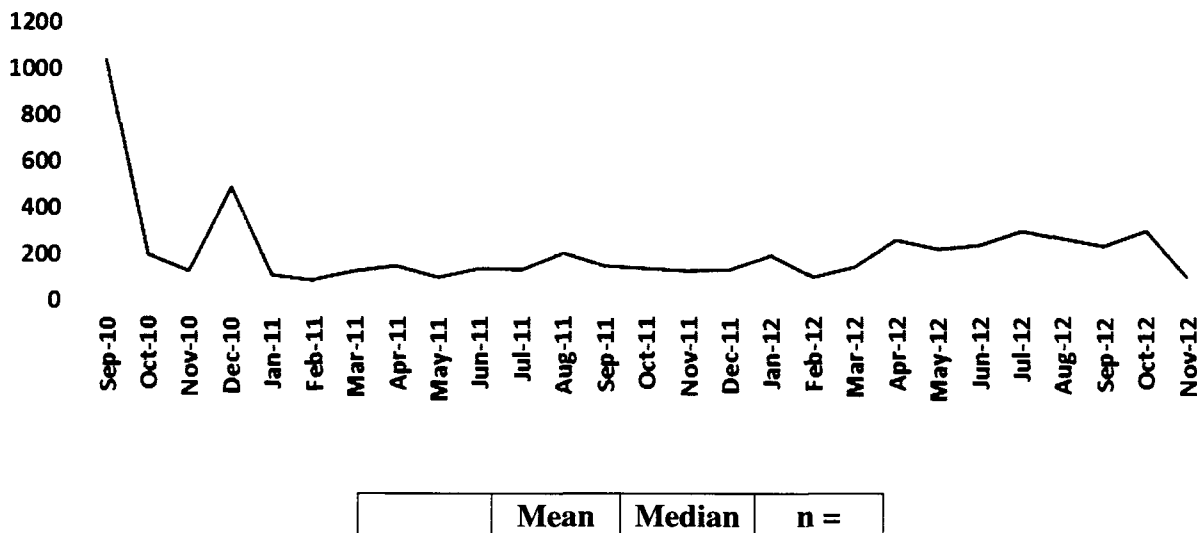
According to this data, the average price of marijuana in Canada during the last four months of 2010 was \$7.26, in 2011 it was \$7.25, and in 2012 the average price was \$7.64. Thus, although there were seasonal variations in 2010 and 2011, the yearly price of marijuana was fairly stable, with a possible increase in price towards the end of 2012. Further exploration of other data would be required to hypothesize regarding the source of this possible restriction in supply (or increase in demand).

Mean and median price per gram, by reporting month



The following graph shows the number of reports per month over the 27 month period where the price of marijuana was recorded on the website. Reporting rates have been fairly stable and consistent. While the number of reports per month seemed to be consistent over the graph, the month of September 2010 and December 2010 have higher amount of recorded reports. The drop in November 2012 is due to the fact that the data set contained only data through November 9th. Those 27 months considered together, a mean of 213 reports per month is registered. The number of reports for certain months is low, so the statistical reliability of the data for individual units of analysis may be difficult; creative grouping and a combination of descriptive statistics and qualitative analysis may need to be used in future research.

The number of reports, by month



	Mean	Median	n =

9/2010	\$7.69	\$7.39	1,036
10/2010	\$7.32	\$7.57	200
11/2010	\$7.15	\$7.04	126
12/2010	\$7.50	\$7.04	487
1/2011	\$7.69	\$7.39	111
2/2011	\$7.05	\$7.22	86
3/2011	\$7.56	\$7.13	124
4/2011	\$7.27	\$7.04	148
5/2011	\$7.35	\$7.22	98
6/2011	\$7.81	\$8.00	134
7/2011	\$7.56	\$7.75	129
8/2011	\$7.37	\$7.04	201
9/2011	\$7.52	\$7.04	148
10/2011	\$7.20	\$7.04	138
11/2011	\$6.94	\$7.04	124
12/2011	\$7.51	\$7.04	133
1/2012	\$7.81	\$7.75	192
2/2012	\$7.24	\$7.39	95
3/2012	\$7.30	\$7.39	141
4/2012	\$6.86	\$7.04	257
5/2012	\$7.74	\$7.04	218
6/2012	\$7.66	\$7.75	239
7/2012	\$7.81	\$7.75	297
8/2012	\$7.99	\$8.45	267
9/2012	\$7.71	\$8.00	231
10/2012	\$7.38	\$7.75	297
11/2012	\$8.52	\$7.75	95

Cost of Cannabis, the Australian example

In Australia, information is collected annually on the purchase and usage patterns of various illicit substances, including cannabis. About a thousand participants (N=902 in 2010) are being recruited each year by The Australian Indigenous HealthInfoNet to complete the Illicit Drug Reporting System (IDRS) – an annual survey of drug users that measures, among other things, the price, price consistency, perceived and measured purity, and availability of various drugs in Australia (Australia Indigenous HealthInfoNet, 2013).

A gram of cannabis is reported by users to be around the \$20 AUD per gram on median, nationally. An ounce of cannabis is set around \$250 AUD/ounce for hydroponic (indoor-grown), and around \$300 AUD for bush (outdoor-grown). Users further reported to that the price of

cannabis has been stable in the 6 months preceding the survey. The above-reported prices have been notably stable since 2000, when the first round of IDRS occurred.

Majority of the sample (57%) said the perceived potency of hydroponic cannabis is high, with another 32% saying it was medium. For bush cannabis, only 25% of the sample said the potency was high, with majority (52%) saying it was medium. Most of the people interviewed in the sample further said that access to cannabis was very easy (54%) or easy (38%) for hydroponic type of the drug, and very easy (41%) or easy (38%) for the bush type of the drug.

Future Research Possibilities

This preliminary examination of publicly available price information will require further research in order to address more sophisticated research questions relevant to operational and policy questions. A selection of “Future Research Questions” is outlined in Appendix 1.

The data extracted from www.priceofweed.com is far from perfect. It is not representative of Canada, nor can its quality be independently verified. However, there are still several advantages to using this data:

- There is no cost to this publicly available data.
- It is a unique and large dataset of the up-to-date price of marijuana, one that does not require any expensive covert operation or actual purchase of the drug.
- The sample is large enough to account for intentional or mistaken entry errors and outliers. Similar to gas prices reporting website www.gasbuddy.com, where drivers voluntarily report gas prices in their vicinity, the erroneous entries may eventually be evened out by the sheer amount of correct entries. Further, the sample has a potential to be even larger with time, assuming the website will be operational for a period of time.
- Data can be harvested and analyzed on continuous basis, provided the website is operational. Important trends in price fluctuations may be continuously monitored.
- Further exploratory research would also be relatively inexpensive, as it could primarily focus on operational data and surveys that are already collected. This type of exploratory research could be accomplished in-house.

Consultation with Partners

Future research would need to start with consultation to refine the research questions. Possible policy stakeholder might include members of the National Anti-Drug Strategy Working Group, the Criminal Intelligence Service of Canada, and the RCMP.

Additional Data Sources

There are various other data sources that can be used to further the objectives of this project.

- The **Canadian Alcohol and Other Drug Use Monitoring Survey (CADUMS)** administered by Health Canada, is an “on-going general population survey of alcohol and illicit drug use among Canadians aged 15 years and older, that was launched in April 2008” (Health Canada, 2011). Furthermore, CADUMS was “designed to provide detailed [...] estimates [across all 10 provinces] of alcohol and drug-related behaviors and outcomes” (Health Canada, 2011). It can be used to have an estimate of the number of marijuana users in Canada.
- The **Marijuana Grow Initiative**, administered by the Royal Canadian Mounted Police (RCMP), provides data on marijuana growing operation that was “dismantled by the RCMP under the authority of a search warrant” (RCMP, 2011). It can be used to develop a time line to see if law enforcement seizures and/or dismantling operations are affecting the price of marijuana in respect to the supply and demand in the industry of marijuana markets.
- The **Consumer Price Index (CPI)**, administered by Statistics Canada, is an “indicator of changes in consumer prices experienced by Canadians. The CPI is widely used as an indicator of the change in the general level of consumer prices or the rate of inflation” (Statistics Canada, 2012). It can be used to see if the price of marijuana has been affected by the CPI (i.e. inflation) over the years.
- The **Uniform Crime Reporting (UCR)** Survey, administered by Statistics Canada in cooperation with police services, collects police-reported crime statistics. UCR data can be used to determine the number of drug offences by police service, indicate the general intensity of policing of drug crimes by region (e.g., by creating ratios of drug incidents compared to other policing incidents, and provide the clearance rate of drug offences.
- The **Adult Criminal Court Survey (ACCS)**, administered by Statistics Canada, is a census of federal statute charges heard in provincial and superior criminal courts in Canada. It includes information on the age and sex of the accused, case decision patterns, sentencing information regarding the length of prison and probation, and amount of fine, as well as case-processing data such as case elapsed time. Thus, for the relevant drug offences, the degree to which criminal justice action results in offender incapacitation or expenses related to criminal activity could be roughly estimates.
- The **Silk Road**, an anonymous website dedicated to the sale and purchase of contraband products, in particular illicit drugs. The transactions between the seller and the buyer are executed using a virtual currency called Bitcoin in a completely anonymous manner. Because the website operates as a Tor hidden service similar to the torrent system of downloading copyrighted music, software, and television material, it is extremely hard to trace the origin and the destination of the drug. The website’s monthly revenue is estimated at \$1.2 million (Christin, 2012).

Through a technique called web-scraping, where static data from webpages is recorded into logs and later on sorted into desirable format, the **Silk Road** website, like the Price of Weed website, could prove to be an important source of information for the price, availability, quality, and perhaps the mapping of a relationship between the buyers and the sellers of drugs. It could potentially create a snapshot of the state of the drug marketplace in Canada. There may be ethical issues, such as a breach of expectation of privacy, that arise from extracting even the publically-available data on the price of illicit drugs.

- Other drug-related forums, like <http://www.bluelight.ru/vb/> ; <http://www.drugs-forum.com/index.php> ; <http://www.erowid.org/> , may prove to be a source of information for drug prices, availability, and quality as reported by forum users. As in the case of the Sild Road, web-scraping techniques might need to be applied in order to extract the required information from the websites. Again, ethical issues may arise from extracting even the publically-available data on the price of illicit drugs.
- The **Census of Population**, administered by Statistics Canada, would be used for population statistics. This information could be used in combination with other data sources to estimate the level of policing of drug offences by populations of users, as well as estimated consumption volumes and value of the drugs consumed.

Conclusion

This paper examined user-reported marijuana price information that was crowd sourced and made publicly available by the web site www.priceofweed.com. The data used in this study cannot be used for refined statistical studies, due to too few data points. However, inferences can be drawn regarding some general trends.

The preliminary analysis indicates that there are some significant regional differences in marijuana prices. Where prices are lowest (British Columbia, Quebec and New Brunswick) a significant fraction of their production may be exported, where prices are nearer to the national average (Alberta, Saskatchewan, Manitoba, Ontario, Nova Scotia and Prince Edward Island) it may be that less of the production is exported, while in areas where the cost is high (the Territories and Newfoundland and Labrador) it may be that a significant proportion of demand is met through imports.

There also appears to be a rough price increase for marijuana around mid-winter, declining into the spring, with a price spike again at the start of the summer declining in the fall. A price spike in summer and a decline in the fall might be explained by a restriction in supply at the start of the outdoor growing season and some increase in supply due to outdoor summer production being released onto the market. However, a price spike in mid-winter with declines into the spring is more difficult to explain. It is expected that indoor marijuana growers can produce multiple crops per year, evening out price fluctuations. This data may indicate additional indoor producers starting growing, or indoor producers expanding production, or outdoor growers moving indoors, in the Fall. In any of these cases, additional production coming on-line in the late fall and early winter may result in lower prices in the spring.

The preliminary analysis indicates that although there were seasonal variations, over 2010 and 2011 the yearly price of marijuana was fairly stable, with a possible increase towards the end of 2012.

Further exploratory research, combining this type of data with other sources of data may provide indications of the role of organized crime in the marijuana trade, as well the effectiveness in operations and policy designed to restrict supply.

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Appendix 1: Future Research Questions

Policy and law enforcement and performance measurement

Using the economic principles of the law of supply and demand in combination with price information may allow inferences to be made regarding whether or not policing operations as measured by existent data such as clearance rates, seizures and disruptions have quantifiable impacts on drug price, markets and overall supply. It is assumed that the supply of the drug will be restricted as policing efforts disrupt producers and distributors of marijuana, resulting in higher prices. In the context of the marijuana illicit drug market, these are some possible research questions:

- a) Is there a relationship between the price of marijuana and the clearance rates for related offences?
- b) Does the 'intensity of policing' of marijuana markets impact the price of marijuana or the structure of marijuana prices groupings?
- c) Can mapping the prices of marijuana along a timeline accurately inform us about price changes? If yes, two other research questions are options:
 - i. Are legislative changes associated with changes in the price of marijuana?
 - ii. Do police operations such as prevalence of seizures, prevalence of grow operation disruptions, or sentences of offenders affect the price of marijuana, and if so, how?
- d) Does the prevalence of a police presence (i.e., officers by population) relate to the price of marijuana?

Organized crime and the prices of marijuana

Price information might be used to make inferences regarding the activities of criminal organizations.

- a) Are there research ideas that could be borrowed from the literature on gas price fluctuations?

There is a literature on how gas price fluctuations can be used to indicate the possible existence of price fixing cartels. In the marijuana market, this would indicate the existence of a price fixing extra-legal governance agent (i.e. larger criminal organization) or the conspiracy of a cartel arrangement.

- b) Are there geographically-contiguous locations where there have been differential shifts in price or consistent differences in price?

These prices "frontiers" may be likely areas of market and production differentiation, and most likely sites for between-group competition and violence. Using the findings from the

Brantingham et al. (2012) gangs study and the work of Daudelin (2010), it may be theorized that the more stable the price in the different regions, the worse violence flare-ups at the frontier could become, since this may be indicative of market management by concentrated criminal organizations with little contact between them.

Other factors related to marijuana prices

There are likely many factors that can influence the price of marijuana and its fluctuation. Geographic, socio-economic, environmental and inflation are some of the factors that may have an impact on marijuana price. In future research, these secondary factors would need to be controlled in order to answer the research questions above. To this end the following research questions might be posed:

- c) Is there a periodicity to price changes? Does this relate in any way to the production cycle period of marijuana (roughly 16 weeks)? Does this relate to seasons? Does this relate to region of consumption? (For instance, some regions may be more reliant on marijuana grown outdoors or imported by ice roads).
- d) Is there a relationship between the local CPI and the price of marijuana? What would any differences mean?
- e) Are fluctuations in the price of marijuana more reflective of changes in consumption patterns, usage rates, or the amount of enforcement and available supply?
- f) What is the ratio of the price of the ounce market and the gram market? Are there differences in different regions? (This may indicate a different structure to the retail trade segment of the market and may indicate the number and structure of wholesale marijuana dealers versus retail marijuana dealers.)
- g) Besides consumption rates, are there other demographic factors associated with marijuana prices or changes in marijuana prices (i.e. volatility)?
- h) If we (can) know from Census data about the social class of neighborhoods, can we compare low and high income areas and the price of marijuana? (This may not be possible with www.priceofweed.com data since the geographic unit is too broad.). Following the same approach using the Census, how does a portrait of a neighborhood affect marijuana prices when information about seizures are taken into an account?